The Electrical Industry's Weekly Magazine December 14, 1959

Electrical World

Price 50 Cents

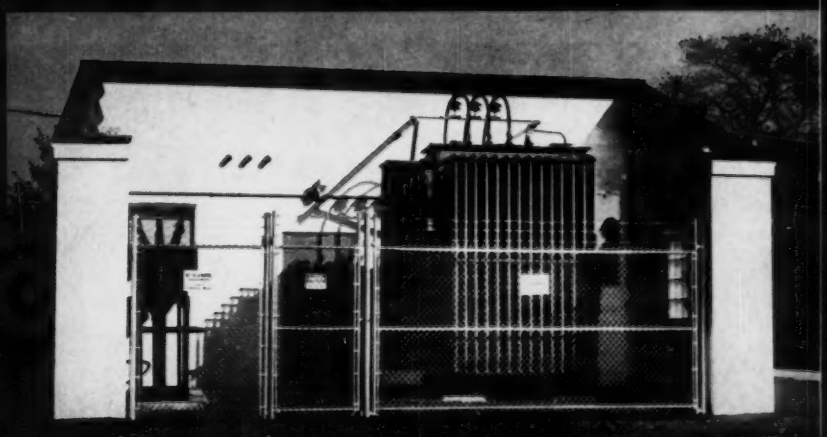
A McGraw-Hill Publication

Novel Residential Substation Is Quiet, Attractive, Economical

... page 53

FRONT VIEW

REAR VIEW



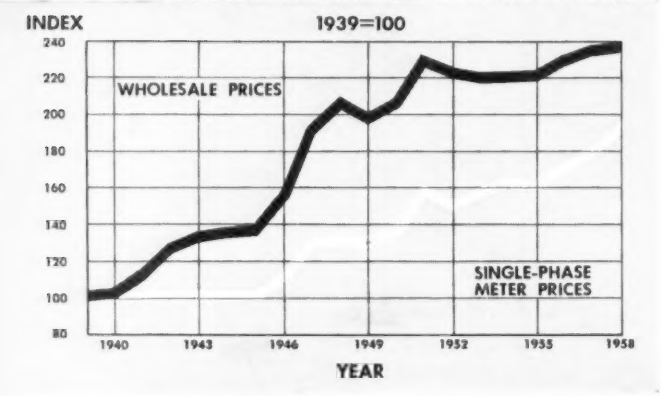
Full Report on AEIC Annual Meeting ... page 46

UNIV MICROFILMS INC
EDITORIAL DEPT
313 N FIRST ST
ANN ARBOR MICH

THE METER PRICE STORY

At General Electric, constant re-evaluation of meter design and manufacturing techniques helps keep prices low in the face of rising costs

SINGLE-PHASE METER PRICES VS WHOLESALE PRICES



WHILE WHOLESALE PRICES for 2000 commodities have risen 140% since 1939, single-phase watthour meter prices have risen only 90%. In effect, this represents an inherent and very real price reduction.

During the past twenty years, electric utilities might have spent an additional 350,000,000 dollars for watthour meters except for the continuing leadership of General Electric in maintaining stable prices in the face of rising costs.

As shown on the chart at left, if prices of watthour meters had kept pace with rising prices of 2000 other commodities in the government's wholesale price index, the utilities would have experienced considerably higher meter prices . . . over one-third of a billion dollars in total.

The rising trend of wholesale prices means increased costs for everyone . . . manufacturers and customers alike. For example, the prices for the three major raw materials used in watthour meters—copper, aluminum, and silicon steel—have all risen substantially during the past twenty years. Wages have also increased significantly during the same period. However, in the face of these direct increases in meter manufacturing costs, meter prices have remained substantially below wholesale prices of commodities included in the government's index.

General Electric contributions to watthour meter design have been instrumental in reducing cost per KVA of capacity from $20.35 in 1923 to $0.32 in 1958. Similarly, General Electric has led the way in manufacturing efficiency. Through simplified designs, coupled with large investments in automation, better products at inherent savings to the customer have become standard.

For complete details on THE METER PRICE STORY, call your nearest Apparatus Sales Office. General Electric Company, Section 301-410, Schenectady 5, New York.

COMBINING LABORATORY ACCURACY with production line efficiency, General Electric's new Electronic Test Unit is just one example of cost-reducing automation utilized in meter manufacture.

Progress Is Our Most Important Product

GENERAL ELECTRIC

Electrical World

Published for 85 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

Vol. 152, No. 24 DECEMBER 14, 1959

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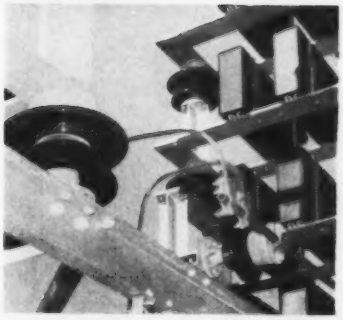

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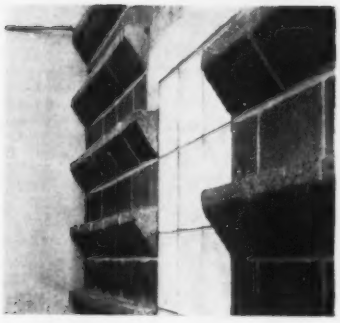

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Herman B. Wolf, Duke Power Co

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Floyd W. Buck, United Illuminating Co

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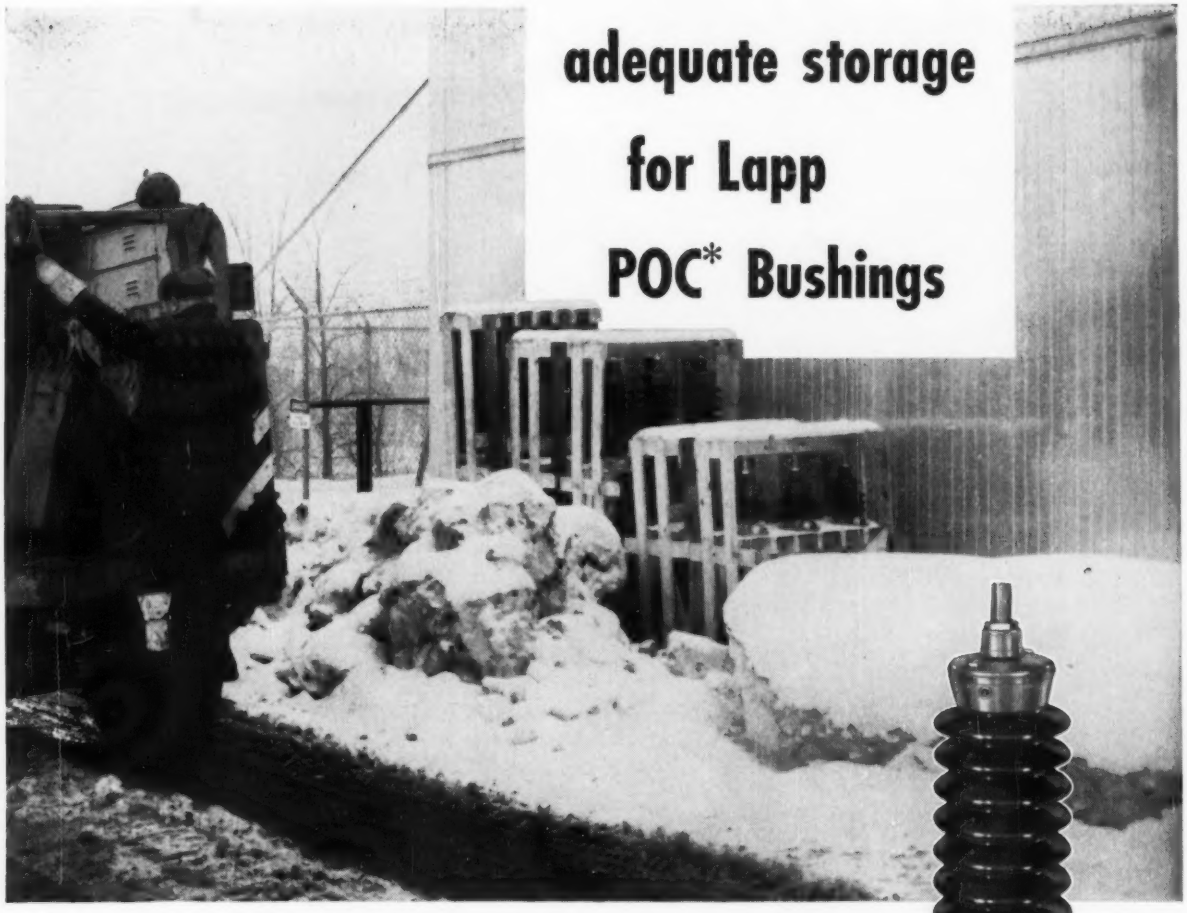
This is adequate storage for Lapp POC* Bushings



There's no special care needed in handling or storing Lapp POC* Bushings. No overhead for expensive storage space. Leave them in their crates, indoors, outdoors, wet, dry, in pole yards, even at substation sites. Weather won't hurt them over any period of time.

This is because Lapp POC* is the totally-enclosed bushing design. Its paper-oil insulated condenser core is housed and protected end-to-end. All exposed insulation is *porcelain,* including the shank. It pays off in service, too, because porcelain is inorganic . . . won't track or deteriorate under leakage current from surface contamination.

Lapp POC* Bushings meet ASA standards. Their small diameter permits their use as high-performance replacement for bushings (15 kv to 161 kv ratings) on any transformer equipment . . . new or old . . . on your system. Let us show you how you can reduce stock inventory, save on warehouse space and cost . . . and improve system reliability . . . by stocking only required sizes of Lapp POC* Bushings together with necessary flange adapters.

Lapp Insulator Co., Inc., Le Roy, N. Y.

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POC*

BUSHING

*PAPER-OIL CONDENSER TYPE
TOTALLY-ENCLOSED CORE
ASA STANDARD

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LETTERS

". . . Always Worth Checking"

To the Editor:

I have enjoyed your column, "Politics and Public Power." While we are not always in complete agreement, it is always worth checking.

The comments in the issue of Nov. 16 relative to Upper Colorado River power were, to my mind, well put. It is a matter of some complexity, yet one on which all power users have maintained a rare degree of cooperation.

I was especially pleased by the phrase "all the approximately one-million kw of power from the projects is expected to be requested by preference groups." We have found some hesitancy by some to accept a preference demand of this magnitude. The reference to the problem of transmission cost for distant users was also significant.

Howard E. Scott, Manager
Colorado Rural Electric Association
Denver 3, Colorado

We always are happy to get comments, pro or con, on "Politics and Public Power," as indeed an any material published in EW. To term P&PP as "worth checking," to us, is a compliment.

We must caution Reader Scott, though, that our reporting that preference customers are expected to request *allocations for the full amount of CRSP generation in no way implies our endorsement of the validity of their requests.*

That Nasty Word "Profit"

To the Editor:

Your Management Newsletter of Nov. 30 touched one of my long standing pet peeves. Regardless of the merits as to the actual inherent qualities of the word "profit," i.e., whether it is really a good or a nasty word, I just cannot understand the insistence and effort that has been put forth to have it accepted as respectable.

Economists of a couple of generations back used to use the word "profit" to mean "generally excessive earnings." I am afraid it still has this meaning to far too many people of whom a large number should know better. But their purposes are best served by industry itself so long as it continues the use of the word "profit" when a more respectable word such as "return" or "earnings," for example, or possibly some other would serve the intended meaning as well, and whose mere use would not so readily stir up criticism and opposition.

C. W. Watchorn
Pennsylvania Power & Light Co.
Allentown, Pennsylvania

When **M** STRANDS go up

your costs come down

It's true economy to install guys and messengers made of Copperweld Type M Strand. There are no maintenance costs—no replacement costs. Because Type M Strand is non-rusting, you eliminate, once and for all, the problems and expense caused by the deterioration and failure of rust-weakened guys and messengers.

Type M Strand gives you the same long life and freedom from maintenance that has distinguished Copperweld Products for over 40 years. Each wire is permanently protected against corrosion by a heavy copper sheath inseparably molten-welded to an alloy steel core. And, because of the molten-weld, the copper will not crack, flake or peel. Easy to handle—easy to install—Type M Strand can be readily bent, served, moused or clamped.

You can see that Type M Strand offers economies you can't afford to pass up. Put this strand up and prove it for yourself.

COPPERWELD STEEL COMPANY
WIRE AND CABLE DIVISION **Glassport, Pa.**
For Export: COPPERWELD STEEL INTERNATIONAL COMPANY, New York

Copperweld® TYPE **M**™ **STRAND**

FOR GUYS AND MESSENGERS

You can save money on line construction with Graybar as your auxiliary warehouse

Use Graybar as your auxiliary warehouse for line construction materials and you make substantial savings of both time and money – in planning, ordering, checking. Save on inventory and transportation costs.

This is because Graybar stocks just about everything needed for line construction, "from the top of the pole – to the bottom of the hole" – and can deliver it all promptly to your central warehouse, substores or work centers.

Another important source of savings – the wide variety of construction tools available from Graybar that help speed the job.

Start with a local call . . . Have your local Graybar man stop in for a discussion.

Employee-owned Graybar has been on the line and part of the local scene for years. Whether you require 3 items or 3,000, Graybar is your centralized source for most electrical utility equipment and supplies.

When Graybar is your auxiliary warehouse —	You save on storeroom costs Reduce inventory investment Insure prompt delivery Step up manhour efficiency Simplify bookkeeping

943

GraybaR

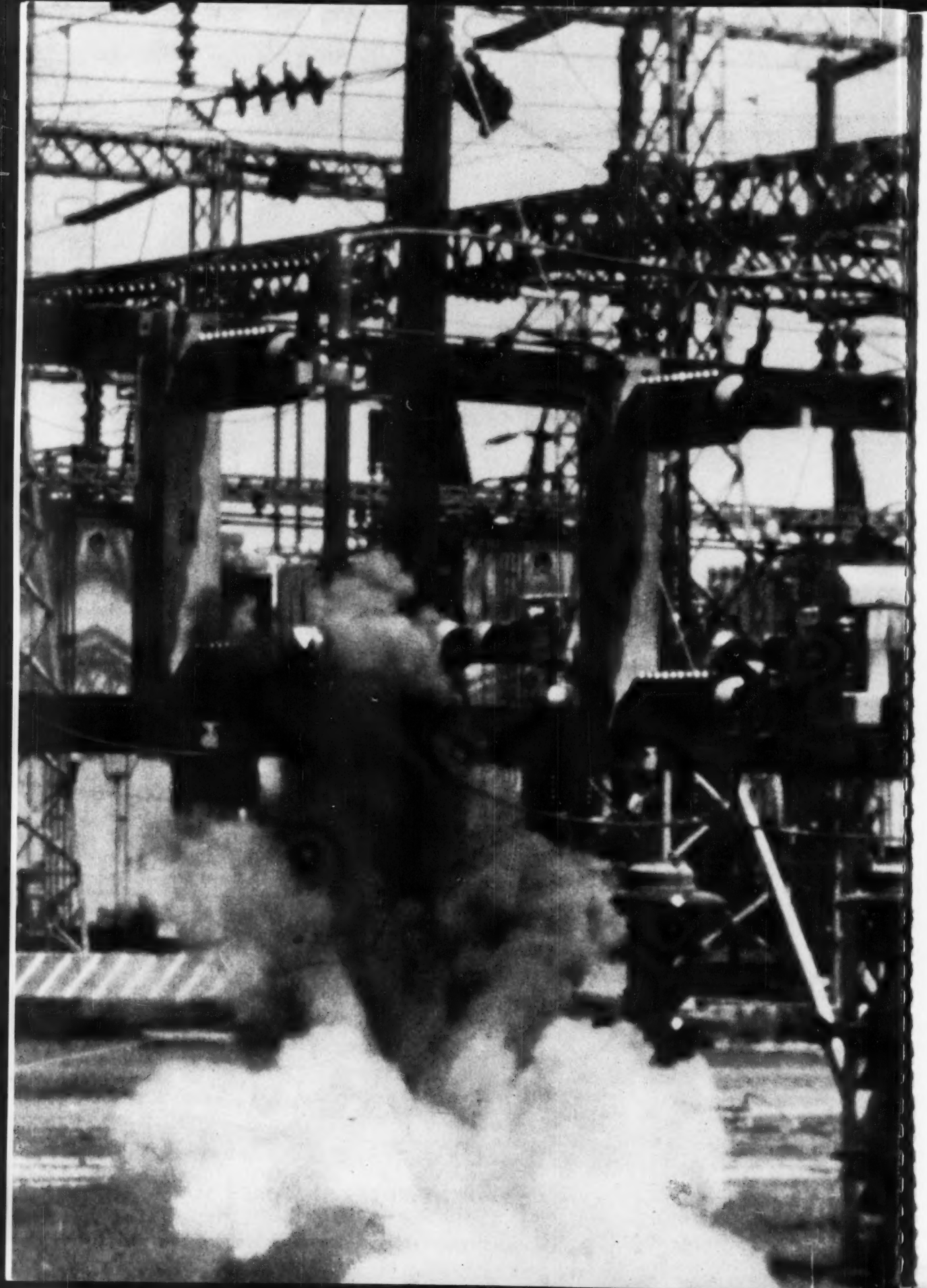
ELECTRIC COMPANY, INC.

420 Lexington Avenue, New York 17, N. Y.

Everything Electrical GraybaR

IN OVER 130 PRINCIPAL CITIES

LOCAL SERVICE TO UTILITIES THROUGH COAST-TO-COAST WAREHOUSING



Here is a 1,900,000 kva test shot on an S&C power fuse

...But what does it prove?

Absolutely nothing . . . without complete instrumentation and test data

TEST DATA

Data on Test Circuit	
* Normal frequency, cycles/second	60
Bus voltage, phase-to-phase, volts, rms	38,100
Bus voltage, phase-to-ground, volts, rms	22,000
* Power Factor	Less than 12%
Available Fault, computed	
Kva, three-phase, symmetrical	1,900,000
Amperes, rms, asymmetrical	46,500
Amperes, rms, symmetrical	29,200
Data Taken During Line-to-Ground Test	
From Magnetic Oscillograms	
* Normal frequency, cycles/second	60
Bus voltage (normal frequency), volts, rms	38,100
* Recovery voltage across fuse (normal frequency), volts, rms	22,000
* Current through fuse, amperes, rms asymmetrical	42,300
Arcing time, cycles	0.8
* Total clearing time, cycles	0.8
Arc energy, watt-sec.	383,000
Arc power, peak, watts	110,000,000
From Cathode Ray Oscillograms	
Natural frequency, cycles/second	19,000
Recovery voltage, across fuse	
(Normal frequency) volts, peak	31,000
(Natural frequency) volts, peak	32,000
Rate of rise, volts per μsec ($4E_{o\text{-}p}$ f x 10^{-6})	2,430

*Required by AIEE and NEMA testing standards

—such as the quantitative record (shown at left) of this short circuit test shot.

without skillful analysis

Even when the fuse clears, the test data have to be critically examined. For example, could this apparently successful test shot have been just a lucky—or easy—break? Was the natural frequency of the circuit unrealistically low? Was the rate of rise and/or the amplitude of recovery voltage across the fuse high enough? Does the arc energy developed suggest marginal operation? These questions are tough to answer for anyone but a fuse expert. They aren't covered in NEMA or AIEE short circuit test standards.

without multiple shots

For a given test condition, numerous shots must be made to factor the variables of fuse ampere rating, manufacturing tolerances, and minor differences in construction.

without a vast testing complex

One test (let alone one *shot*) is no basis for proving out a fuse. It has to be integrated with other tests amassed over the years in the field and in the laboratory, in order to substantiate the published interrupting ratings at all voltages, for all circuit parameters, at all fault levels.

This kind of electrical testing is essential for the performance integrity of a high voltage power fuse. Expensive, yes! But you'll find it anyway behind S&C's type SMD Power Fuse. You won't find it behind the bargain varieties which use ballistics as a substitute for electrical testing.

The reproduction from test film (left) and the test record (above) cover one of 19 shots on one type of SMD Power Fuse on one voltage rating (34.5 kv), at two high fault levels on just one day of testing.

Oh, by the way, all that the 19 shots proved was that the SMD is satisfactory for very high (and tough) phase-to-ground faults on a 34.5 kv system. That's all S&C got from a single day's testing! It's simply a small part of the 20-year testing complex which backs up the SMD's ratings.

S&C ELECTRIC COMPANY
4421 Ravenswood Avenue, Chicago 40, Ill.

S&C

Citric Acid -- Dowell's New Service for Cleaning Stainless Steel Process Equipment

Now, for the first time, plant operators can be sure of a new degree of safety in the cleaning of their pressure units containing austenitic stainless steel—for example, heat exchangers, stainless-clad pressure vessels, atomic reactors, and supercritical-pressure steam generators. Citric Acid service by Dowell provides a new, effective method for these special chemical cleaning situations.

The Citric Acid used in Dowell chemical cleaning is inhibited with an *exclusive chloride-free* inhibitor. Cleaning with this new field-proven solution assures a chloride-free solvent system, and thus helps prevent chloride stress-corrosion cracking.

Dowell Citric Acid also provides other significant advantages: Citric Acid stabilizes dissolved iron and helps prevent precipitation of insoluble iron compounds when neutralizing chemicals are used. Flushing of the unit is not as difficult when Citric Acid is used. Citric Acid is especially suitable where stainless steel and other metals are used together in construction of the unit.

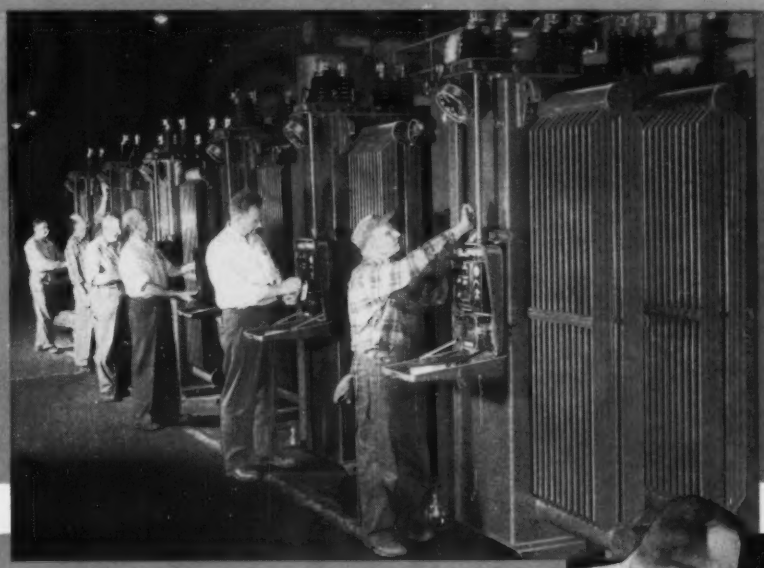
Citric Acid cleaning with a chloride-free inhibitor is just one of the new ideas from Dowell research. Other recent contributions include the new "white glove" standards of cleanness, copper removal agents and the new jetting device for cleaning heat exchanger tube bundles.

Ask your Dowell representative about Citric Acid service and Dowell chemical cleaning programs for your plant equipment. Dowell, the leader in chemical cleaning service and research, operates in every major industrial area through 165 offices and stations. Dowell, Tulsa 1, Oklahoma.

Chemical cleaning service for all industry DOWELL

DIVISION OF THE DOW CHEMICAL COMPANY

ALLIS-CHALMERS... Pacing Power Progress



Parts simplification and mass production methods.

highest quality regulators at lowest cost to you

Allis-Chalmers three-phase regulators

PACK MORE VALUE

Fewer and cleaner designed components in A-C three-phase regulators drastically cut machining and handling time — speed mass assembly manufacturing. Result: *true* low-cost regulation — yet all these advantages nowhere else available *regardless of price*. 33% less space required, 20% less weight for easy handling, lower installing cost. 30% less cost per kva of three-phase regulation and 160% *Vari-Amp* ratings offered to 600 amp maximum.

Regulator facts fast! Call, wire or write...

ALLIS-CHALMERS

Originators of 5/8% Step Regulators

A-1206-E

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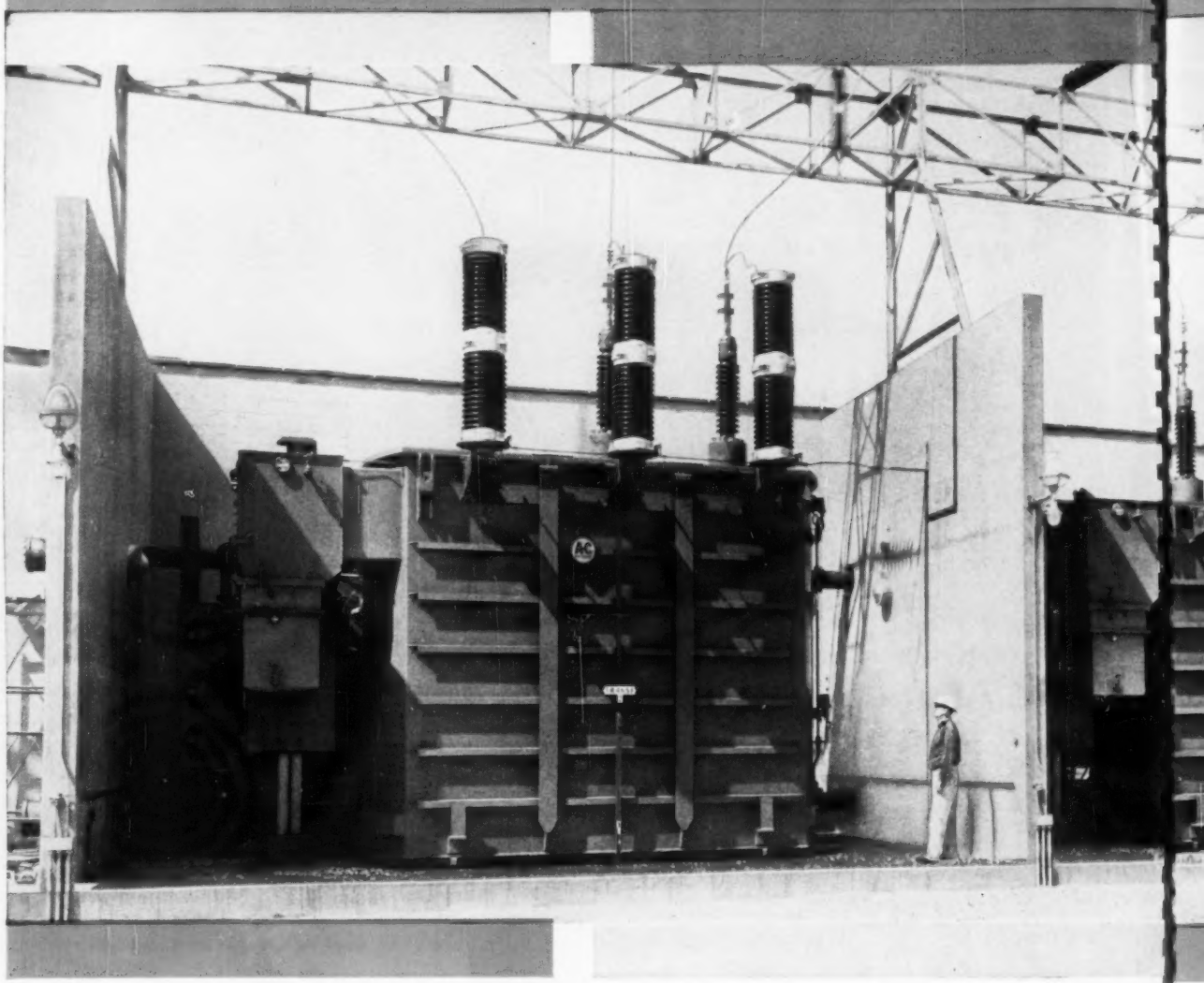
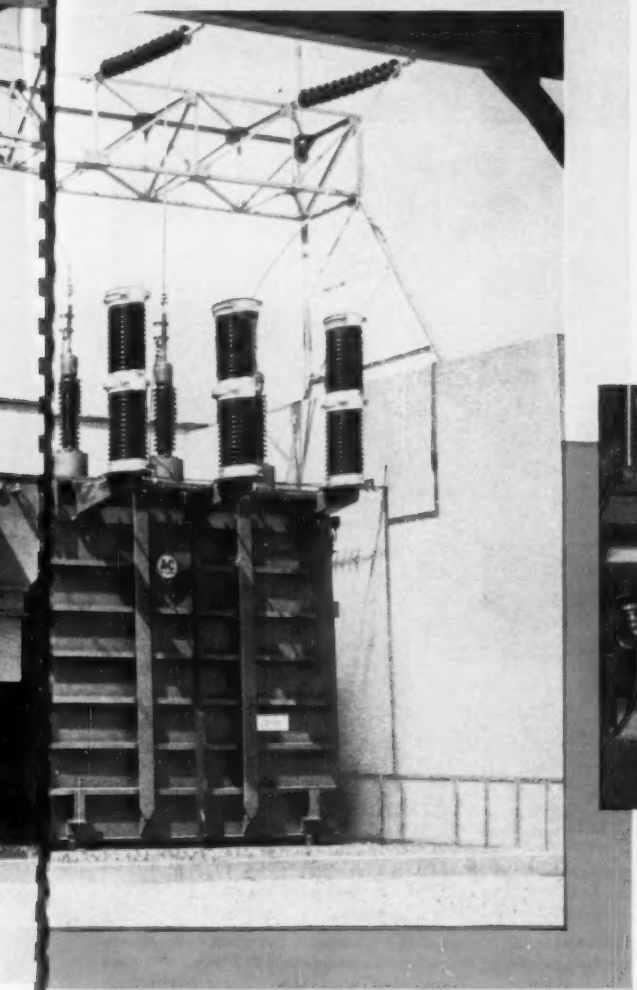


AT WISCONSIN ELECTRIC POWER COMPANY

Dual cooling takes the heat off emergency loads

*Patented

Power Progress



Manual shutoff valves serving transformer cooling equipment piping are opened when dual cooling is necessary. A transformer can be taken from service without draining the oil from the unit or its piping.

A-1155-E

Either of two 90-mva transformers is capable of carrying 2/3 of the combined capacity by using the "dual-cooled" feature

Wisconsin Electric Power Company counts on *designed-in* power transformer emergency capacity. Exclusive *dual-cooled* arrangement* uprates either one of the 90-mva transformers to 120 mva if the other is removed from the line.

The active transformer utilizes all of the other unit's oil-to-air cooling equipment to dissipate heat. In normal operation, each transformer uses its own coolers independently.

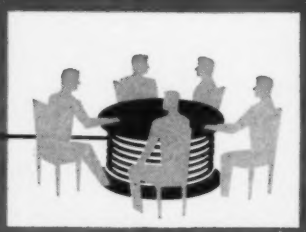
Stepping down 138,000 volts to 13,800 volts, the transformer bank employs accordion-type expansion joints between transformers. Header pipes allow for manual cutoff. The installation has been designed to permit adding a third transformer should demand require it.

Dual cooling is but one of many A-C advantages resulting from continuing transformer research. Others include corona-free design, quiet operation, reduced size and weight, high short-circuit strength. A call to your A-C man will bring further dual-cooling power transformer details.

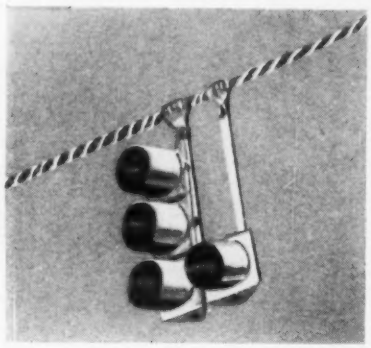
ALLIS-CHALMERS A-C *POWER FOR THE FUTURE*

WIRE AND CABLE ROUND TABLE

DU PONT



Harrisburg traffic-control system uses cable wraps made of Du Pont plastic



Low-cost cable wraps are being used in the new traffic-control system in Harrisburg, Pa., as a solution to the problem of binding electric wires. SPIRAP® cable wraps, manufactured by AMP Inc., Harrisburg, Pa., are spirally cut plastic tubes which depend on plastic memory to grip articles. They eliminate tedious wire lacing and pulling of wires through spaghetti tubing.

AMP manufactures three types of SPIRAP cable wraps. The SPIRAP suitable for most applications is made from Du Pont ALATHON polyethylene resin, because it resists acids and alkalies, is totally unaffected by most organic solvents below 122°F., and has a useful temperature range between -112°F. and 200°F. SPIRAP of Du Pont RULAN flame-retardant plastic offers qualities similar to those of ALATHON, but adds the advantage of flame retardance. SPIRAP of Du Pont ZYTEL nylon resin is used principally for aircraft and military operations, where resistance to higher temperatures and excessive abrasion are required.

The new SPIRAP is another example of how the superior qualities of ALATHON, RULAN and ZYTEL are used in the creation of new and better products.

Du Pont does not manufacture wire and cable, but supplies thermoplastic resins for insulation and jacketing.

POLYCHEMICALS DEPARTMENT

DU PONT

REG. U.S. PAT. OFF.

Better Things for Better Living . . . *through Chemistry*

• Two workers pull wire from reel as third inspects for correct feeding. (Inset) Worker easily strips covering of ALATHON in preparation for connection.

Rochester Gas & Electric relies on line wire covered with Du Pont ALATHON®

Because of its many proven advantages, Rochester Gas & Electric now depends upon polyethylene to cover 95% of their line wire. Harry Saddock, standards and transmission engineer for RG&E, states: "Rochester prides itself on its cleanliness and beauty as a city. We help improve the appearance of our pole lines by reducing the number of separate conductors through using line wire covered with polyethylene resin."

This is accomplished by running triplex 1/0 secondary cable pole to pole with mid-span triplex #4 service connections. To save valuable time, RG&E prefers pre-assembled cable with a spacer. ALCOA supplies the wire covered with ALATHON 5 BK 22.

Having used line wire covered with ALATHON for over five years, RG&E has other reasons for their preference. They have found that this wire takes up less pole room, and shorter poles can be used, since the clearance between conductors is reduced considerably. They have also found that, when stringing wire through trees, they are able to cut smaller holes.

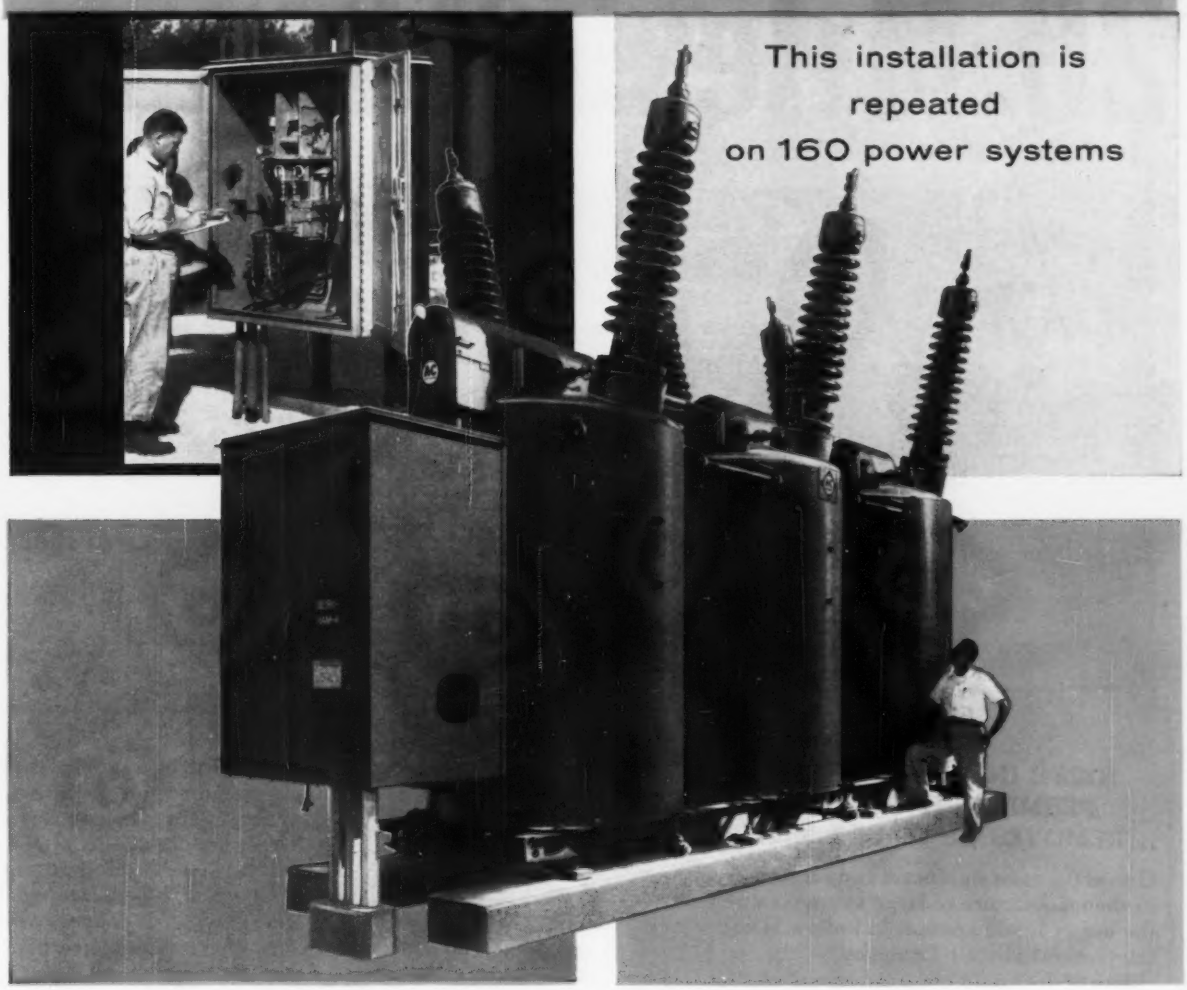
Another important advantage to RG&E is that line wire covered with Du Pont ALATHON is resistant to failures brought about when conductors are whipped together by man-made or natural causes.

For these reasons, plus the fact that ALATHON resists moisture, sunlight, weathering and corrosive atmospheres, Harry Saddock concludes, "We expect this covering of ALATHON polyethylene to outlast the usefulness of the line."

Why not find out how ALATHON or the other Du Pont plastic materials can help solve your problems by writing E. I. du Pont de Nemours & Co. (Inc.), Department M-1214, Room N-2507A, Nemours Bldg., Wilmington 98, Del.

ALATHON® POLYETHYLENE RESINS | **RULAN®** FLAME-RETARDANT PLASTICS | **ZYTEL®** NYLON RESINS

ALLIS-CHALMERS... Pacing Power Progress



It's well underway...the big swing to breakers

with Pneu-Draulic operators

Here's how confidence adds up. An innovation scarcely six years old has won the acceptance of 160 companies — and over 60% have placed repeat orders. That's the dramatic record of the reliable *Pneu-Draulic* operator available on Allis-Chalmers outdoor breakers (14.4 to 345 kv, 500 to 25,000 mva).

Reliable stored energy assures safe emergency closing of breaker at full rated speed onto energized line (even when no control power is available). Use of non-compressible oil instead of air ends use of trouble-causing anti-freeze solutions, eliminates moisture and corrosion problems. And, you get these additional benefits — mechanically trip-free operation, high-speed interruption.

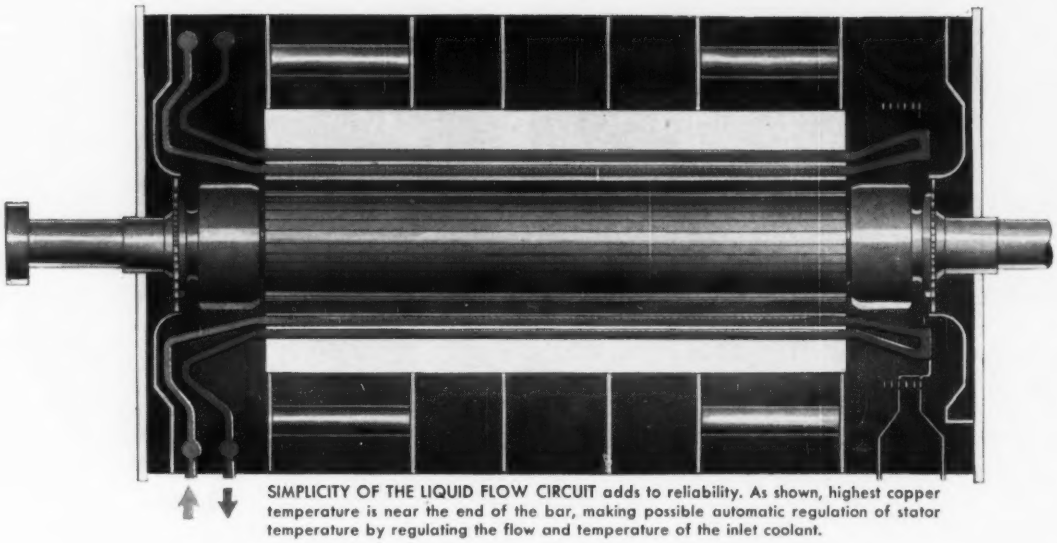
Join the big swing to A-C breakers with low-maintenance *Pneu-Draulic* operators. Call your nearby A-C office or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS

Pneu-Draulic is an Allis-Chalmers trademark.

A-1205-E

20 Miles of Revere



SIMPLICITY OF THE LIQUID FLOW CIRCUIT adds to reliability. As shown, highest copper temperature is near the end of the bar, making possible automatic regulation of stator temperature by regulating the flow and temperature of the inlet coolant.

HELPS INCREASE PERFORMANCE... PERMITS HIGHER UNIT RATINGS ...REMOVES UP TO 16 TIMES MORE HEAT

One of the most significant and successful developments in the manufacture of large steam turbine-generators is the use of liquid coolant in hollow stator windings by the General Electric Company.

Use of the liquid coolant permits smaller frame sizes, since it removes the heat directly from the copper so that up to 16 times more heat may be removed than was possible by former methods. This means improved performance and better utilization of materials, with resultant savings.

In developing the hollow stator bars not only did operating conditions have to be considered but the method of fabrication also had to be reckoned with.

The selection of copper as the metal to be used was virtually a must as the principal purpose of the metal was that it possess maximum electrical and thermal conductivity. But what kind of copper and in what shape was something else.

General Electric engineers, having worked with Revere in the development of hydrogen-cooled rotor bars that permit doubling generator rotor output without increasing the physical size, again called on Revere.

Revere's Technical Advisory Service and its Methods Department cooperated with General Electric engineers. Numerous discussions were held regarding the sizes, tolerances, and temper of the copper which would be most suitable. One of the chief concerns was producing the close tolerances required, on a production basis.

The result was a series of Revere rectangular drawn copper tubes arranged in two tiers to form the stator bars; cross-section of which you see at upper right. The dielectric construction of this liquid-cooled bar is as simple as the conventional bar.

Evidence of the performance of Revere drawn copper tube as liquid-cooled stator bars is the fact that General Electric, since adopting this material, has increased its use to almost a thousand miles.

This is another example of Revere helping "fit the metal to the job," thus saving money while producing a more efficient product. Why don't *you* call on Revere to help with your "important ones?"

REVERE COPPER AND BRASS INCORPORATED

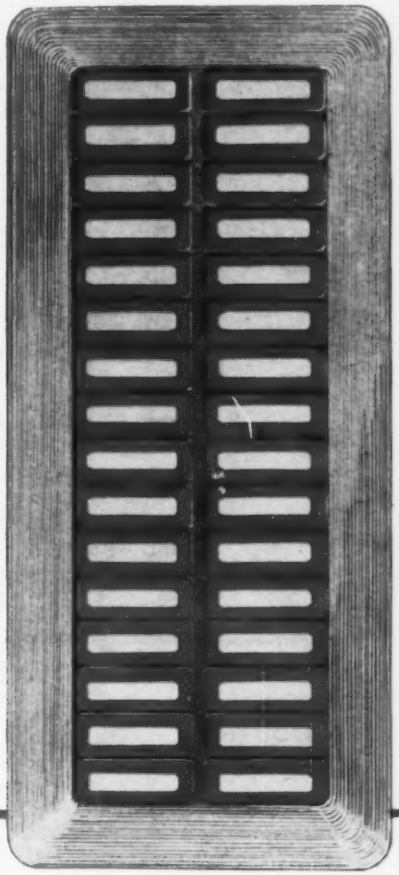
Founded by Paul Revere in 1801

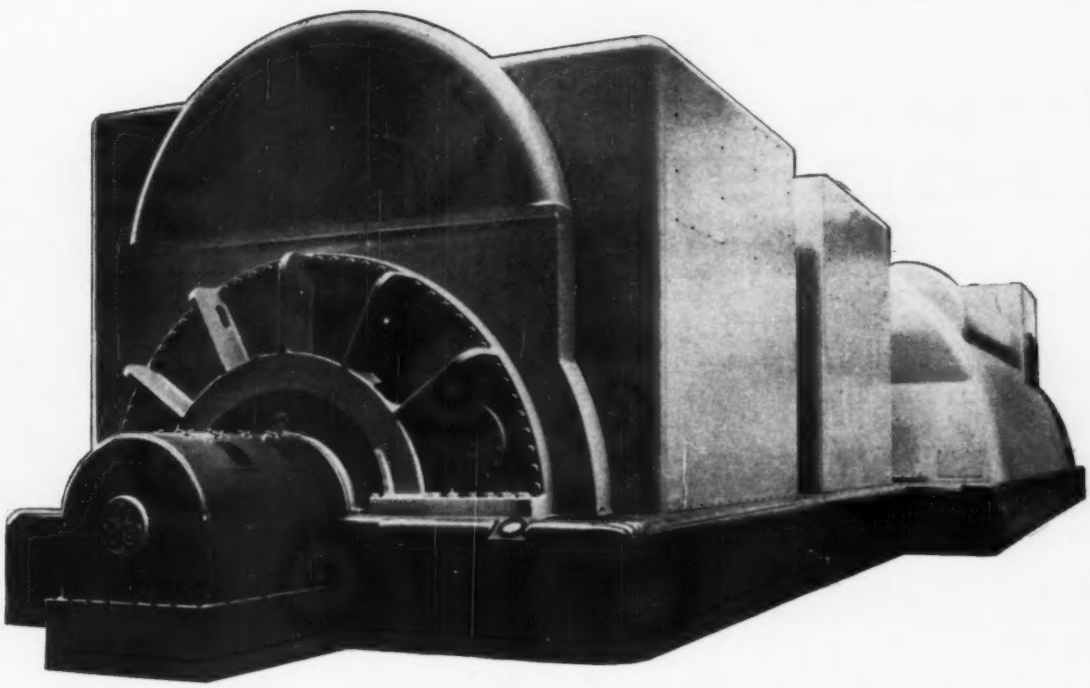
230 Park Avenue, New York 17, N. Y.

Mills: Rome, N. Y.; Baltimore, Md.; Chicago, Clinton and Joliet, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Brooklyn, N. Y.; Newport, Ark.; Ft. Calhoun, Neb. Sales Offices in Principal Cities, Distributors Everywhere.

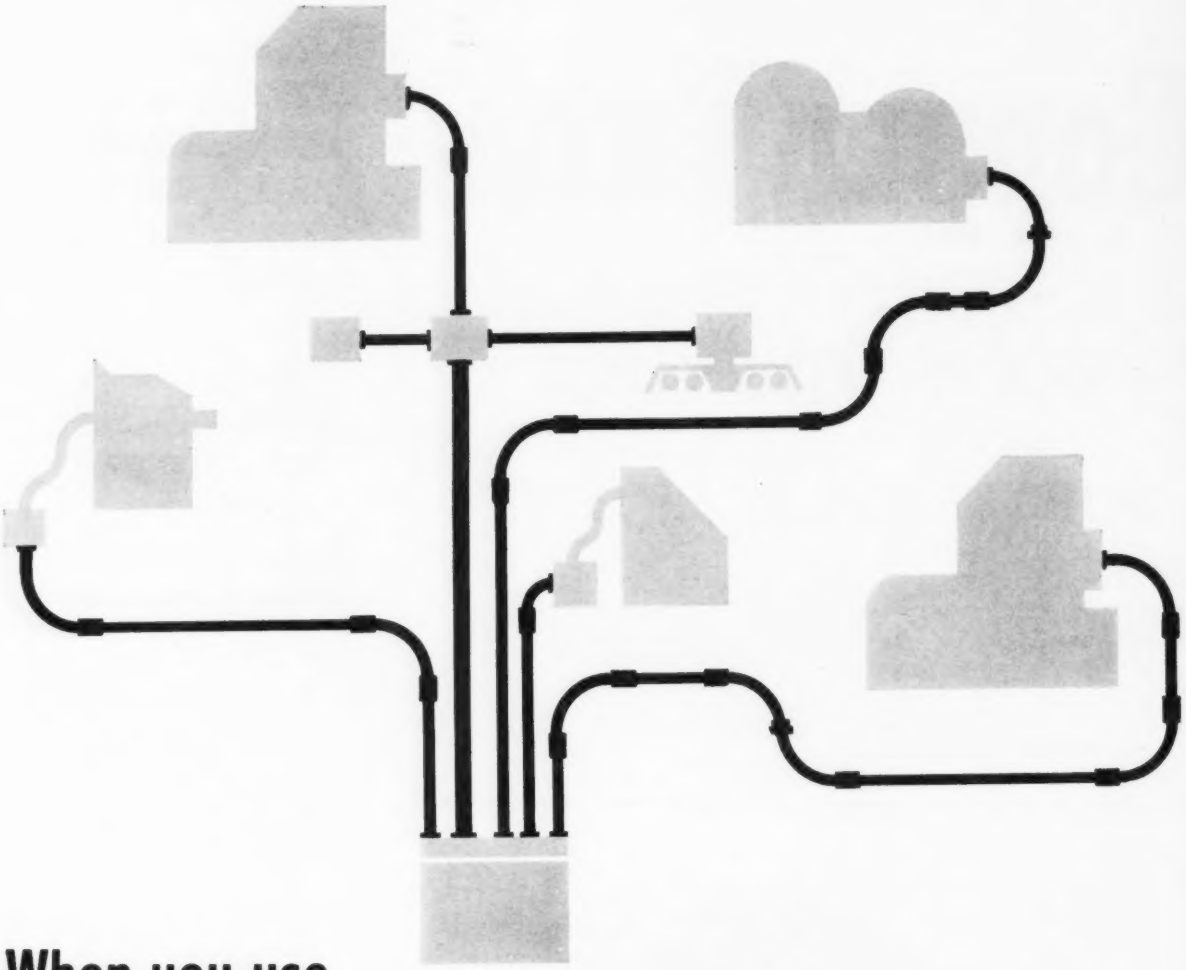
Copper Tube

used as liquid-cooled stator windings in large conductor-cooled generator





GENERAL ELECTRIC CONDUCTOR-COOLED GENERATOR with liquid-cooled stator installed in Linden Generating Station, Public Service Electric and Gas Company, New Jersey



When you use
RIGID STEEL CONDUIT
protection is permanent

Rigid steel conduit has offered builders the greatest protection at the minimum cost for more than half a century. *And it still does:* Steel is the only conduit material available today which gives permanent and near-to-total protection against the hazards inherent in any electrical wiring system: open circuits, short circuits, and induced circuits.

STEEL GIVES YOU STRENGTH AND TOUGHNESS. Steel protects wiring from physical damage both during and after installation.

STEEL GIVES YOU OVER-ALL ECONOMY. Low original cost, low installation cost, and trouble-free service for the life of the building.

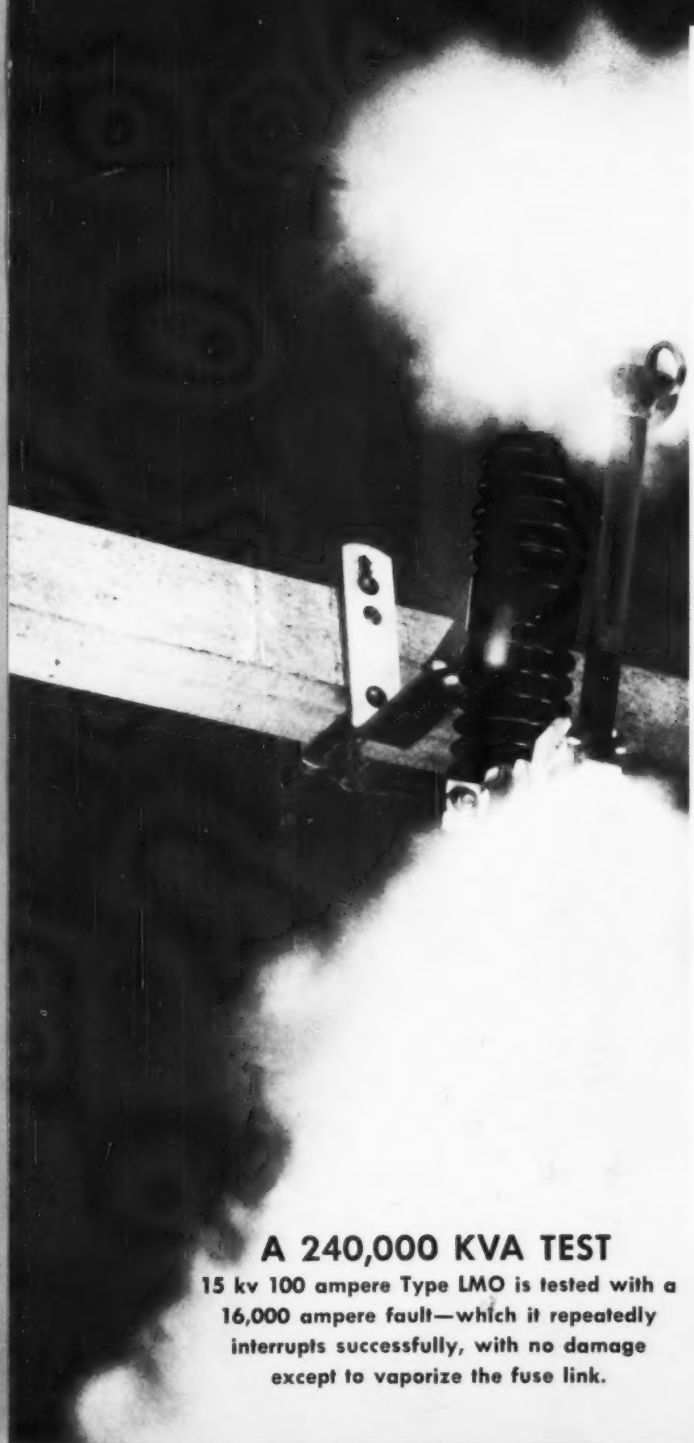
Steel means maximum and permanent protection for the wiring system and for the building. You can be sure only when you use rigid steel conduit—proved by dependable service in millions of installations. Your conduit distributor has full details.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.
Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

LINE MATERIAL ANNOUNCES
A Revolutionary NEW FUSE CUTOUT



Totally Tested Above
240,000
KVA

L-M's new line of open Type LMO Distribution Fuse Cutouts sets new standards far exceeding anything the industry has ever offered. The many new features developed by L-M design engineers make these cutouts an outstanding new engineering achievement.

Type LMO cutouts have been *totally tested*. They have been subjected to hundreds of tests of materials and mechanical and electrical performance. Conditions were way beyond any possible operating requirements, under extreme combinations of physical, environmental, and electrical conditions.

Tests proved that these cutouts operate under a full range of faults. They dependably interrupt currents ranging from slight overloads through the highest interrupting ratings—20,000 amperes at 7.8 kv.

These tests are possible only because L-M operates the world's largest high-power laboratory designed exclusively for testing distribution apparatus, under conditions far more severe than could be obtained on utility company lines.

LINE MATERIAL

Industries

McGRAW-EDISON COMPANY

DISTRIBUTION SPECIALISTS

McGRAW EDISON

A 240,000 KVA TEST

15 kv 100 ampere Type LMO is tested with a 16,000 ampere fault—which it repeatedly interrupts successfully, with no damage except to vaporize the fuse link.

BIRDPROOF—insulated bolts have a dielectric strength that extends voltage rating.

BOTTOM CONTACT—hinge trunnion springs of silver-plated beryllium copper bear against rotating contact of tube assembly to provide high current, low resistance contacts.

HINGES—also provide large electrical contact surface with minimized side play; interlock prevents backward installation.

POSITIVE STOP—tube assembly cannot swing past the down position.

PULL RING—guides hook stick to best mechanical advantage for both opening and closing of the cutout.

NON-CORROSIVE—bronze castings throughout except contacts and springs.

ARMORGLAS™ TUBE—cutout tube is fused fiberglas for extremely high resistance to arc gas (except on 7.8 kv Heavy-Duty); accommodates and functions with all makes of fuse links.

FLIPPER—spring loaded flipper ejects blown link leader, locking action with hinge prevents overtension on fuse links. Groove facilitates installation of link.

15 kv HEAVY-DUTY TYPE LMO CUTOUT.
Actual size 17 1/16 inches overall length

GET COMPLETE INFORMATION:
For complete information on the new Type LMO cutout, contact your L-M Field Engineer; or write, wire or phone Line Material Industries, Milwaukee 1, Wisconsin. In Canada: CLM Industries, McGraw Edison (Canada), Ltd., Toronto 13, Ont.

Be sure to ask your Field Engineer to show you:

Sample of Type LMO.

Type LMO Bulletin No. FC 3.

Type LMO high-speed movie of maximum current interruption.

TYPE LMO RATINGS

VOLTAGE RATING KV	CURRENT RATING AMPS	INTERRUPTING CAPACITY AMPERES—ASYMMETRICAL			
		HEAVY-DUTY		EXTRA-HEAVY-DUTY	
		Non-Expendable Cap	Expendable Cap	Non-Expendable Cap	Expendable Cap
7.8	100	5000	10000	10000	20000
15	100	4000	8000	8000	16000
27	100	3000	6000	—	—

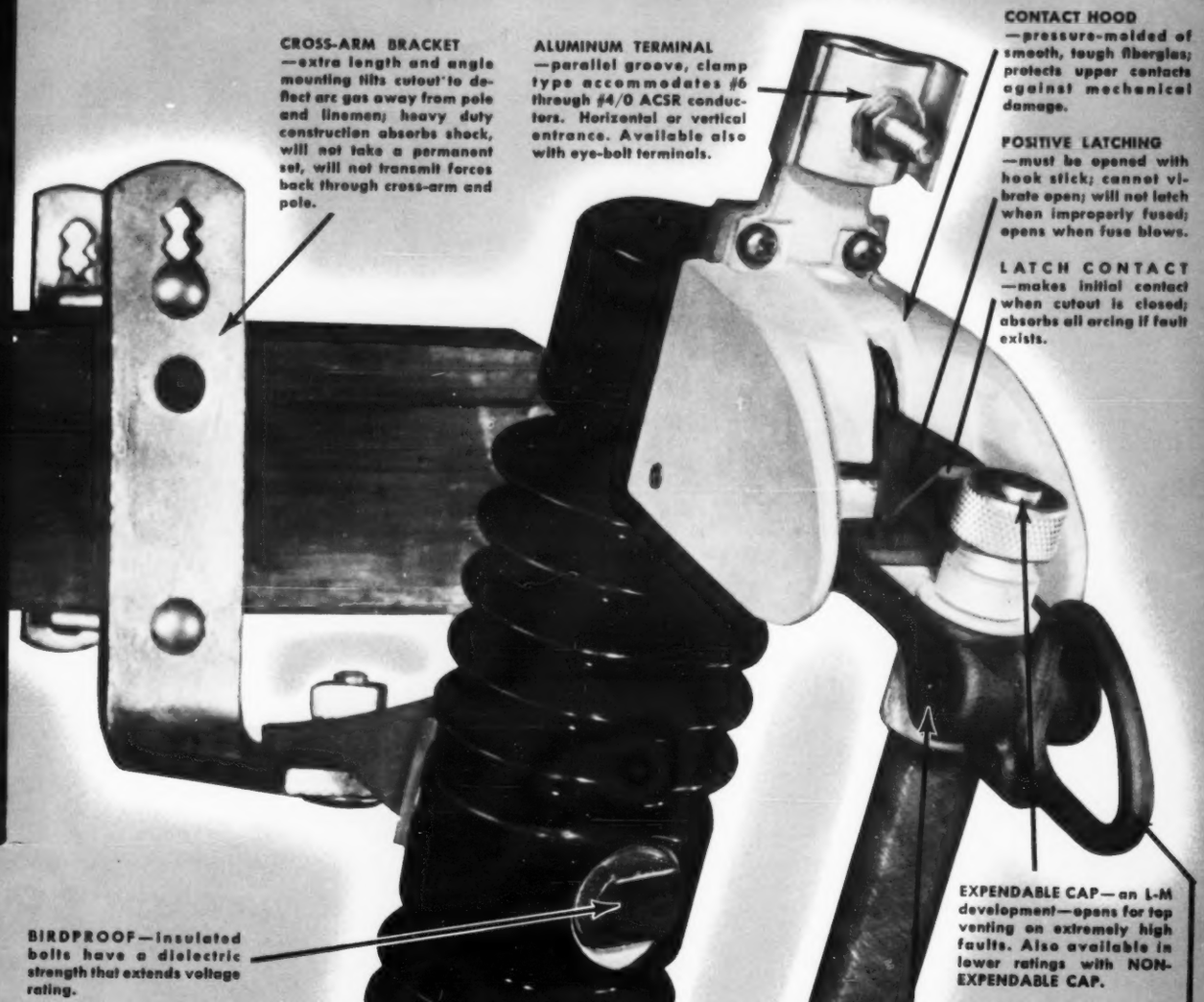
Interchangeable Fuseholders: interrupting ratings may be changed simply by changing the fuseholder. Choice of heavy-duty or extra-heavy-duty fuseholders; 200-ampere disc switch blade; link-break fuseholder. This interchangeability offers convenience and savings in labor, material, and stocking costs.

NEW!

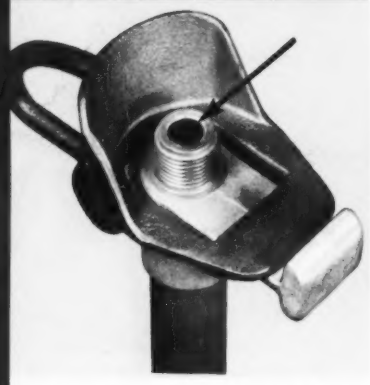
L-M's Totally Tested Type LMO Fuse Cutout

Line Material concentrates all engineering, testing and manufacturing efforts in one direction—equipment for the distribution of electric power.

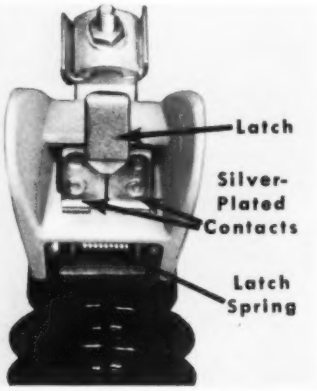
L-M has made fuse cutouts for more than 35 years. L-M introduced the industry's first drop-out cutout. Yet, with all this vast experience, L-M came to you, its customers, to find what you wanted in the best possible fuse cutout. The new LMO line incorporates every important feature our customers asked for—and more.


CROSS-ARM BRACKET
—extra length and angle mounting tilts cutout to deflect arc gas away from pole and linemen; heavy duty construction absorbs shock, will not take a permanent set, will not transmit forces back through cross-arm and pole.
ALUMINUM TERMINAL
—parallel groove, clamp type accommodates #6 through #4/0 ACSR conductors. Horizontal or vertical entrance. Available also with eye-bolt terminals.
CONTACT HOOD
—pressure-molded of smooth, tough fiberglas; protects upper contacts against mechanical damage.
POSITIVE LATCHING
—must be opened with hook stick; cannot vibrate open; will not latch when improperly fused; opens when fuse blows.
LATCH CONTACT
—makes initial contact when cutout is closed; absorbs all arcing if fault exists.
BIRDPROOF—insulated bolts have a dielectric strength that extends voltage rating.
EXPENDABLE CAP—an L-M development—opens for top venting on extremely high faults. Also available in lower ratings with NON-EXPENDABLE CAP.

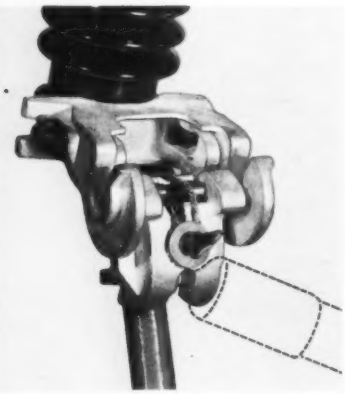
OTHER FEATURES



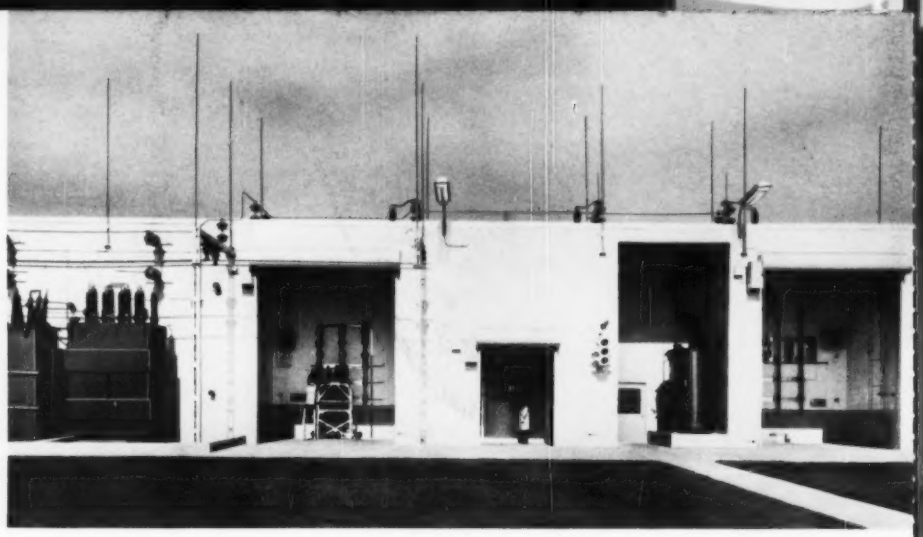
ASBESTOS PHENOLIC LINER. On extra-heavy-duty cutouts. This liner minimizes material erosion from high temperature, high velocity gas expulsion.



UPPER CONTACTS. Double shoe, solid copper alloy with stainless steel springs for low resistance contact; wiping action during make-break. Positive stop prevents overtravel and overstressing contact springs.



LOWER CONTACT. *Lifting Slot* is keyholed to permit easy positive insertion of NEMA-standard hook stick from any position. Tube holder can be removed only when tube hangs down vertically; cannot fall off stick. *Link Leader Thumbscrew* has large winged surface; permits easy gloved-hand re-fusing. *Link Break* fuseholder also available.



LINE MATERIAL'S THOMAS A. EDISON Short Circuit Laboratory at Franksville, Wisconsin. This is the world's largest short circuit laboratory devoted exclusively to the testing of distribution equipment. Only with facilities like this is it possible to produce a *totally tested* fuse cutout like the new Type LMO.

At left, power transformers; three test cells are shown, plus alcove for high amperage (150,000 a.) transformer, with capacitor bank at far right. All tests can be viewed from various angles with closed circuit television cameras and are recorded with high-frequency oscillographs and high-speed cameras.

New L-M Cutouts Totally Tested in this Short-Circuit Laboratory

Line Material's Franksville Laboratory has performed hundreds of tests on the new LMO fuse cutouts.

In this exclusive Line Material facility, tests can be run at any time, under any desired conditions, with complete and accurate control and measurement of results.

Here are some of the tests in which these Type LMO cutouts have been designed and thoroughly proved:

Reliability: mechanical tests of materials, dielectric tests of components, and extensive heat runs were made under conditions far exceeding those encountered in service.

Totally Tested Interrupting Capacity: hundreds of tests prove the LMO can handle extremely high faults, dependably, and without damage to the cutout or other equipment.

Totally Tested Full Range: hundreds of tests from slight overloads through the entire range, with 39 different sizes of fuse links, prove dependable full-range interrupting capacity.

Totally Tested Safety: several hundred test closing-in on faults show the safety of the LMO for the lineman.

Get Complete Information on This Revolutionary New Cutout

Ask the L-M Field Engineer to show you samples of this new cutout, and the new L-M technical motion picture with high-speed photography of maximum current interruption. Or wire or write Line Material Industries, Milwaukee 1, Wisconsin. In Canada: CLM Industries, McGraw-Edison (Canada) Ltd., Toronto 13, Ontario.

LINE MATERIAL Industries

McGRAW-EDISON COMPANY

McGRAW EDISON

432

Distribution Specialists

DISTRIBUTION TRANSFORMERS • KYLE RECLOSERS AND OIL SWITCHES • FUSE CUTOUTS AND FUSE LINKS
LIGHTNING ARRESTERS • POWER SWITCHING EQUIPMENT • PACKAGED SUBSTATIONS
CAPACITORS • REGULATORS • OUTDOOR LIGHTING • LINE CONSTRUCTION MATERIALS
PORCELAIN INSULATORS • FIBRE PIPE AND CONDUIT

The Electrical Week

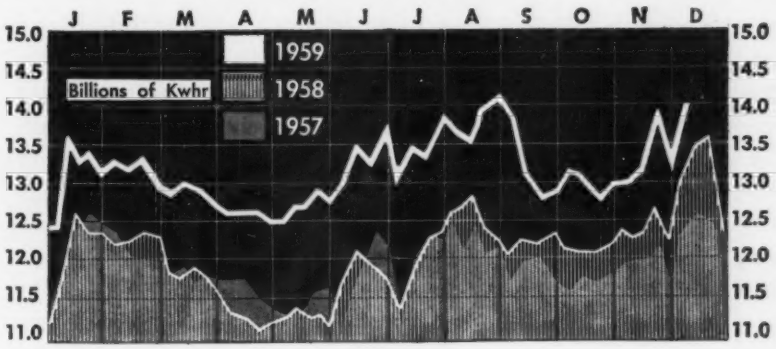
LATE NEWS ▶ **GE unveiled new Residential Market Development Operation** at its Utility Sales Executives Conference in Louisville last week. The program—referred to as R.M.D.O.—through its support of the Gold Medallion Home program, is designed to stimulate interest in all-electric living. It will include trade and consumer advertising, and will have six regional offices to coordinate activities locally.

An electrical rate hike aimed at producing 20% more operating revenues may be in the offing for Memphis LG&W. The City Council last week authorized the utility to retain an engineering firm to make the study; results are expected within a week. Memphis LG&W Pres Ray Morton points to two causes for the proposed hike: (1) Increase in the interest rate on bonds from 3% to 4.4%; and (2) Last year's recession, which cut growth rate from 15% per year to 0.14%.

Around the States . . . Maine PS plans to buy Washburn Electric . . . Idaho Supreme Court refuses to consider its earlier decision against allowing the state to reimburse utilities for the cost of moving facilities necessitated by highway construction . . . Ohio's Gov DiSalle to call meeting of utility and city representatives to discuss change in states rate-base law . . . California-Pacific Utilities Co asks Wyoming PSC to okay 2-for-1 stock split . . . Georgia PSC gives Georgia Power go-ahead on plan to purchase and capitalize service entrances, after certain requirements have been met.

Management changes . . . Southern Electric Generating ups A. E. Burnett to vp . . . F. F. Vaughan becomes Ebasco International exec vp . . . New York State E&G elects K. W. Hasbrouck vp . . . S&C Electric makes S. I. Lindell vp of research and engineering . . . GE Vp R. L. Gibson becomes general manager of Transformer Div in Pittsfield, Mass . . . I-T-E elects A. G. Bosanko to vp, indoor distribution.

WEEKLY POWER OUTPUT—Up 6.8% (Week ending Dec. 5), Kwhr 13,907,000,000



Per Cent Change From Previous Year

	Nov. 21	Nov. 28	Dec. 5
Total U. S.	+ 9.8	+ 7.3	+ 6.8
New Eng	+ 6.9	+ 4.1	+ 3.0
Mid. Atlan.	+ 9.4	+ 7.9	+ 4.9
Cent. Ind.	+10.4	+ 8.8	+ 6.7
West. Cent.	+11.1	+ 6.5	+ 4.6
Southeast	+11.3	+ 7.9	+ 9.4
South Cent.	+ 7.7	+ 7.2	+ 8.7
Rocky Mount	+ 4.9	+ 3.3	+ 2.0
Pacific			
NW	+10.4	+ 1.7	+ 4.6
SW	+ 9.3	+ 8.9	+10.6

Seasonally Adjusted Index 261.1

Week Ago 258.2 Year Ago 243.4

Source: Edison Electric Institute

Preview of this issue

EVENTS ▶ **Clyde Ellis details impressions of his recent Russian tour** of power facilities in an exclusive EW interview. The NRECA general manager, while emphasizing Soviet rural electrification and hydro development, points to what he considers the closing power gap between the U.S. and the U.S.S.R. **(p 40)** . . . New York State Office of Atomic Development may offer to share R&D costs with utilities if they will put up another A-plant to complement Indian Point **(p 44)** . . . The carry-over effects of steel strike are being felt by utilities **(p 43).**

AEIC MEETING ▶ **Utilities will have to take a vigorous interest in politics** if they are to do anything about progressive government encroachment, the Association of Edison Illuminating Companies was told at its recent Boca Raton, Fla., meeting. The urgency, said Pres W. C. Beckjord, dates back to enactment of the TVA bond bill **(p 46).**

ENGINEERING ▶ **Capacitors between transmission substation buses and ground** limit line surges and permit lower transformer BIL, recent Duke Power Co tests show **(p 48)** . . . Aluminum polyethylene aerial cable for 15-kv industrial distribution saves Dow Chemical more than $400,000 in cable costs on 431,000 ft **(p 50)** . . . Sound-attenuating wall, which United Illuminating uses for presentable substations in residential

Politics and Public Power

CONGRESS, ADS, AND TAXES

The fight of the electric power companies for more liberal federal policies toward advertising expenditures may gain some powerful new supporters.

Members of the House Ways and Means Committee listened sympathetically last week when Elisha Hanson, general council of the American Newspaper Publishers Assn, attacked recent rulings of the Internal Revenue Service and the Federal Power Commission. These rulings held that advertising extolling the advantages of private power could not be deducted as a normal business expense.

"No bureaucrat should have the power to penalize some types of advertising and approve others," he said, "This means the government is using its taxing power to penalize the dissemination of information."

"No government agency should be allowed to decide what advertising best serves the particular advertiser and the sale of his product," Hanson added.

His solution is to have the committee amend the Revenue Act to specifically grant full tax deductibility for all advertising.

"The Ways and Means Committee is, of course, the one committee of Congress that the Treasury and the Internal Revenue Service listen to most carefully. Ways and Means writes the tax laws and is the Congressional watch-dog of the agency—keeping a sharp eye on its regulations and a keen ear to complaints from taxpayers about inequities or injustices in the application of the law by IRS.

Some members of the committee indicated they agreed with Hanson in principle at least, though Chairman Wilbur Mills (D—Ark.) raised some questions about placing adver-

service areas, costs only slightly more than a conventional wall (p 53).

PROCUREMENT & PRODUCTS ▶ **GE announces 5% cut in published prices of power transformers** 12,000 kva and higher . . . Bituminous coal producers look for a 9% rebound in production next year (p 79) . . . Allis-Chalmers energizes nuclear test reactor . . . Pennsylvania Transformer has new gas analysis method for detecting incipient transformer faults . . . English Electric starts work on two single-shaft, 350-Mw turbine generators (p 80) . . . Instrument systems for steam turbine control are revised, reducing panel requirements by 65% . . . Tilting insulator switch is available in voltage ratings from 7.5-23 kv, 400 and 600 amp (p 85).

MANAGEMENT ▶ **"Fair value" offers the best route to adequate utility earnings,** according to American Telephone & Telegraph Co, and it's high time utility managements pressed for it. Here is the AT&T case for adoption of a fair value rate base, the last of three articles on the relationship between profits and progress (p 91).

SELLING ▶ **Kansas town cuts crime and accidents with new street lighting** . . . FHA approves built-in appliances under its property-improvement program, according to Living for Young Homemakers mag (p 98).

tising entirely beyond the reach of the IRS.

The Ways and Means Committee is not considering specific legislation in its current hearings and no immediate action is in prospect. But the chances are increasing that Congress will face up to the issue, and consider a new set of ground rules.

Another voice in Congress has spoken up loud and clear on the issue—Rep Overton Brooks (D—La.) of the key Government Operations Committee, which has authority to investigate all government agencies.

Brooks charged what many private utility officials have been saying all along—that the Federal Power Commission and the IRS ruled as they did on ECAP ads because of pressure "by forces in and out of Congress which favor more government in the electric power business."

"These folks have been disturbed", says Brooks, "by the fact that electric power companies are using advertising to inform the public about threats to their industry from government encroachment."

Brooks says flatly that he sees no difference in principle whether advertising is used to meet competition a company gets from private firms, or competition from government.

"In fact, to me, we should be even more jealous of the right of private business and industry to protect itself against government than against private competition because of the police power inherent in government," the Congressman said.

Brooks contends that "demands and pressures" against such advertising have not come from the utility customer or from the public generally, but from "a few persons who seek to silence the voice of business that opposes what they are actively promoting."

Executive Reader

Transformation of sound into electrical energy will have applications in many fields, including the home, reports the developer of the transformation system. An amplifier using "electro-chemical" units produces power from electrical impulses generated by a microphone pickup. One model of the system, about 1-ft square and weighing less than 5 lb, produced 250 w. First applications will power phonographs and replace the conventional generator in an automobile. If used in a 24-in. TV receiver, the unit reportedly would cut power requirements to about 7 w. **Eugene A. Russell, president, Electronics Developments, Inc. Tampa, Fla.**

A new basis for the ohm and the volt may come from attempts to improve the values assigned to the electrical standards by using an alternate basis for absolute determinations. This alternate approach is based on a calculable capacitor and a highly accurate capacitance bridge. Work is underway on a new realization of the ohm, and plans have been made for a new realization of the volt. **Summary Technical Report STR-2418, Office of Technical Information, National Bureau of Standards, Washington 25, D.C.**

Underground rock in its natural state and setting will be examined with a special closed-circuit 16-mm TV camera and lamps. This combination in a plastic bubble will be lowered into the rock base to test its solidity before a 52-story building is built in Boston. The camera will cover 360 deg horizontally and 180 deg vertically.

Almost all planning problems faced by utility system planners will be programmed in the future for solution on digital computers. Development of such programs will greatly reduce engineering time required under present methods.

Coal ignited by high-voltage current will provide more than 70 billion cu ft of gas, mostly for the Angrenskaya Power Station, from Russia's largest underground gasification plant recently placed in operation, Pravda reports. Coal reserves in the Angrenski coal field in Uzebekistam are estimated at more than 45 million tons. **McGraw-Hill World News, Moscow.**

Training time cut from 18 months to six months is the fruit of an educational program for operating personnel. Under the program, one training group attends four hours of classroom work per week, with four hours of field work per day; the other is given on-the-job assignments with regular operating shifts. After four weeks, the groups swap training assignments. A participation chart to plot students' alertness, interest, response and progress is used by the instructor to guide the advancement and participation of students in classroom work. **Public Relations Dept, Central Louisiana Electric Co, Pineville, La.**

FUTURA CIS*

O-B Suspension Insulators

*CORROSION INTERCEPTING SLEEVE

...and it's built to stay stronger!

Futura insulators similar to the one shown above have served 15 years in locations where other insulators are failing in one to five years.

Thirty years ago, even in the locations referred to above, this type of corrosion failure was almost unheard of. And it wasn't until many years later that two of the major causes were revealed as atmospheric contamination and high voltage stress -- both of which were found to accelerate corrosion failure.

The point we'd like you to consider is this: how much more common will corrosion failure become as atmospheric contamination -- and voltages -- increase over the next 10 . . . 20 . . . 30 years?

Would you hazard a guess as to where and when you'll need this protection? Or would you rather *get it now, on every tower, at no extra cost?*

OHIO BRASS COMPANY, MANSFIELD, OHIO

Ohio Brass HOLAN

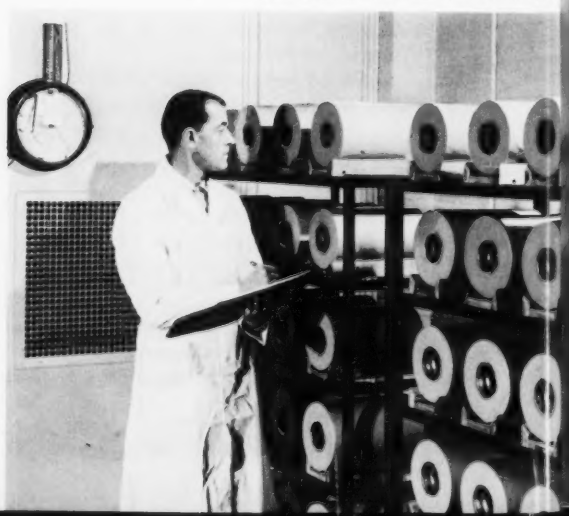
PORCELAIN INSULATORS · LINE HARDWARE · CAPACITORS · LIGHTNING ARRESTERS
BUSHINGS · HOLAN TRUCK MOUNTED POWER DEVICES AND BODIES · BRONZE VALVES

4961-H

Behind this number
of VAREX®

Fixing responsibility for materials, methods is basic step to product improvement

Source, type and lot of all raw materials are readily identifiable from records for each serial number.



lies the full story quality control

A complete data processing record is kept on each Varex capacitor and keyed to the serial number. Give us the number and we can quickly tell you the source, type and lot of raw materials . . . the day it was made . . . the people who made it . . . the log of evacuation procedure . . . the final factory test results.

Why is such a system important to you? It provides, first of all, a complete master check on each production detail, a basic step in any successful quality control program.

It fixes responsibility. Every supplier of material, every O-B employee knows that what he contributes to a Varex unit is a matter of record.

It also provides a sound, precise fund of knowledge for making product improvements in an orderly way. If we change a material or process, even slightly, we can pinpoint the effect immediately and evaluate the results during the factory testing program.

When it's necessary to correlate factory procedure with field performance, it's much easier when we have complete case histories on each capacitor.

At the moment we sincerely believe you're getting the best capacitor available when you buy Varex. But we know there is always room for improvement, in any product. That's why we're doing everything possible, and individual product identity is just one phase, to make sure these improvements come as fast as possible!

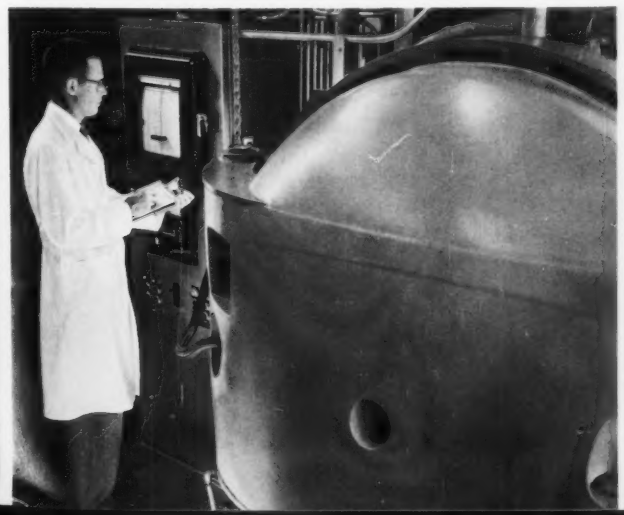
OHIO BRASS COMPANY, MANSFIELD, OHIO

4961-23H

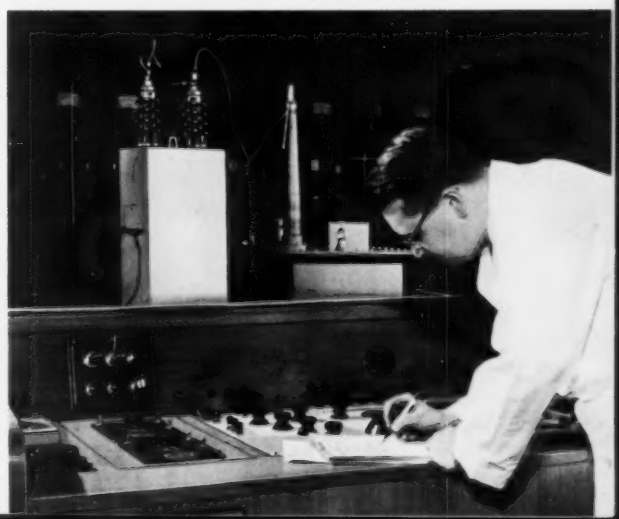
Ohio Brass (B) HOLAN

PORCELAIN INSULATORS · LINE HARDWARE · CAPACITORS · LIGHTNING ARRESTERS
BUSHINGS · HOLAN TRUCK MOUNTED POWER DEVICES AND BODIES · BRONZE VALVES

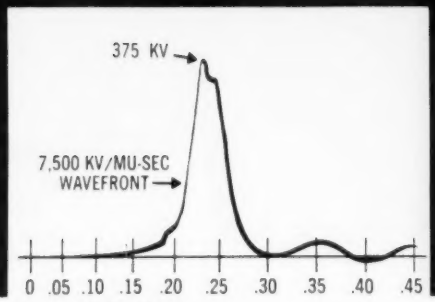
Evacuation procedure is logged carefully; log becomes part of a permanent record.



Final electrical tests build fund of fundamental knowledge from which we can proceed to improve the product.



After this, lightning looks easy



Oscillogram of steep-wave flashover of O-B distribution post. In addition to seven-inch model (below), O-B has a nine-inch post which has withstood similar flashovers.

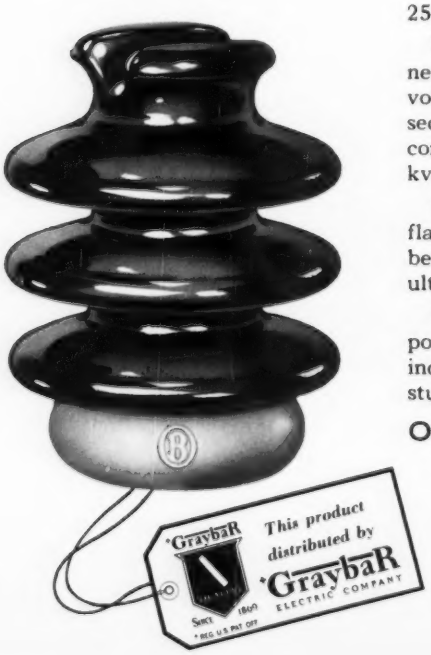
O-B distribution post withstands ultra-steep waves of .05 microsecond front

If you want protection against lightning damage built right into the insulators for your next distribution line (up to 25 kv), take a good look at the O-B distribution post.

We've just seen new evidence of its ruggedness. With the help of new testing techniques and of new instrumentation, the O-B high-voltage laboratory has produced ultra-steep wave fronts of .05 microseconds and under (remember when a 1½ microsecond front was considered a severe discharge?). Rate of rise of the wave is 7500 kv per microsecond.

The photograph was taken approximately .01 microseconds *before* flashover and shows the extreme stress exerted on the insulator just before it flashes over — visual proof of ability to stand up under these ultra-steep waves.

O-B has two models of this distribution post. One has a seven-inch porcelain height with 11 inches of leakage distance; the other is nine inches high with 15 inches of leakage distance. You have a choice of studs and brackets to provide a variety of mounting arrangements.



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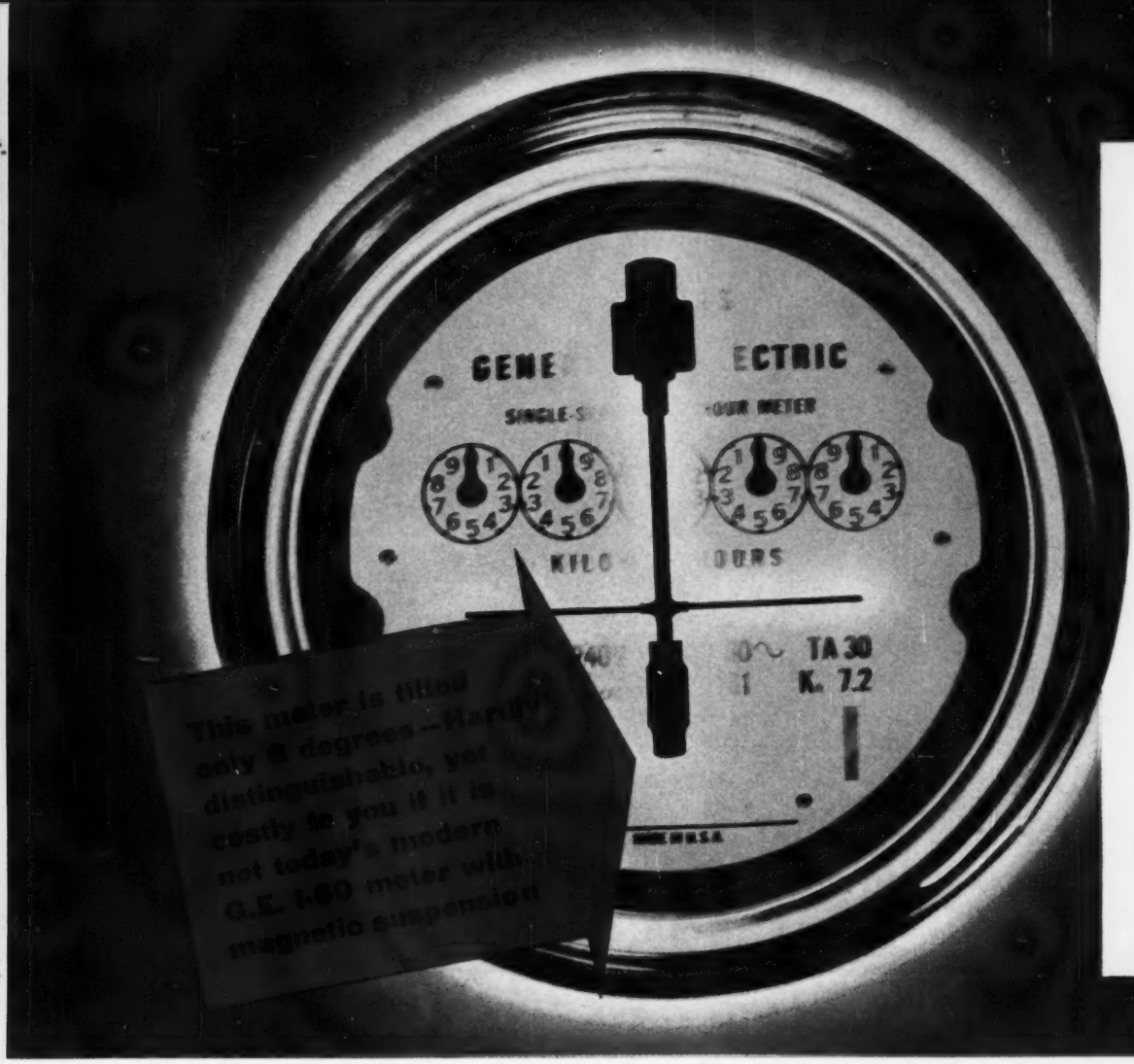


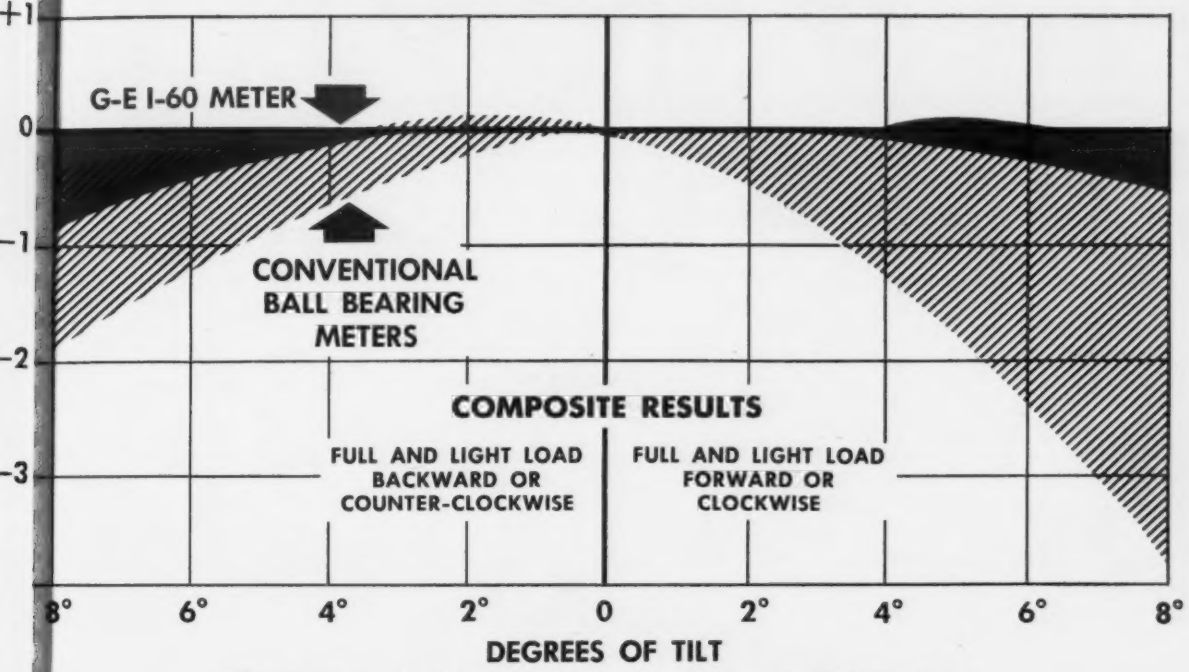
No need for lost revenue from tilted meters...

Untold numbers of watthour meters in service today are operating at a tilt from true vertical. This condition may be due to improper mounting, to accident, molesting of the installation, or uneven settling of the house, pole, or building on which the meter is installed.

Regardless of how "tilt" occurs, however, the fact is that, with old-style, ball-bearing assemblies, *tilted meters run slow, thereby causing revenue losses.* Actually, a single ball-bearing meter—tilted *just six degrees* from vertical—can cost a utility as much as $50.00 in 30 years of operation. Multiply this figure by the number of meters *you* have in service . . . then read the next page for a solution to this problem, which is costing you and other electric utilities hundreds of thousands of dollars in lost revenue every year.

AVERAGE TILT ERROR

3W, 240V, 30-amp, Class 200 Single-stator Meter



NOTE: *The gray area contains the average results of three manufacturers' conventional class 200 ball-bearing meters. The red area contains the average results of General Electric's Class 200 I-60 meters with magnetic suspension.*

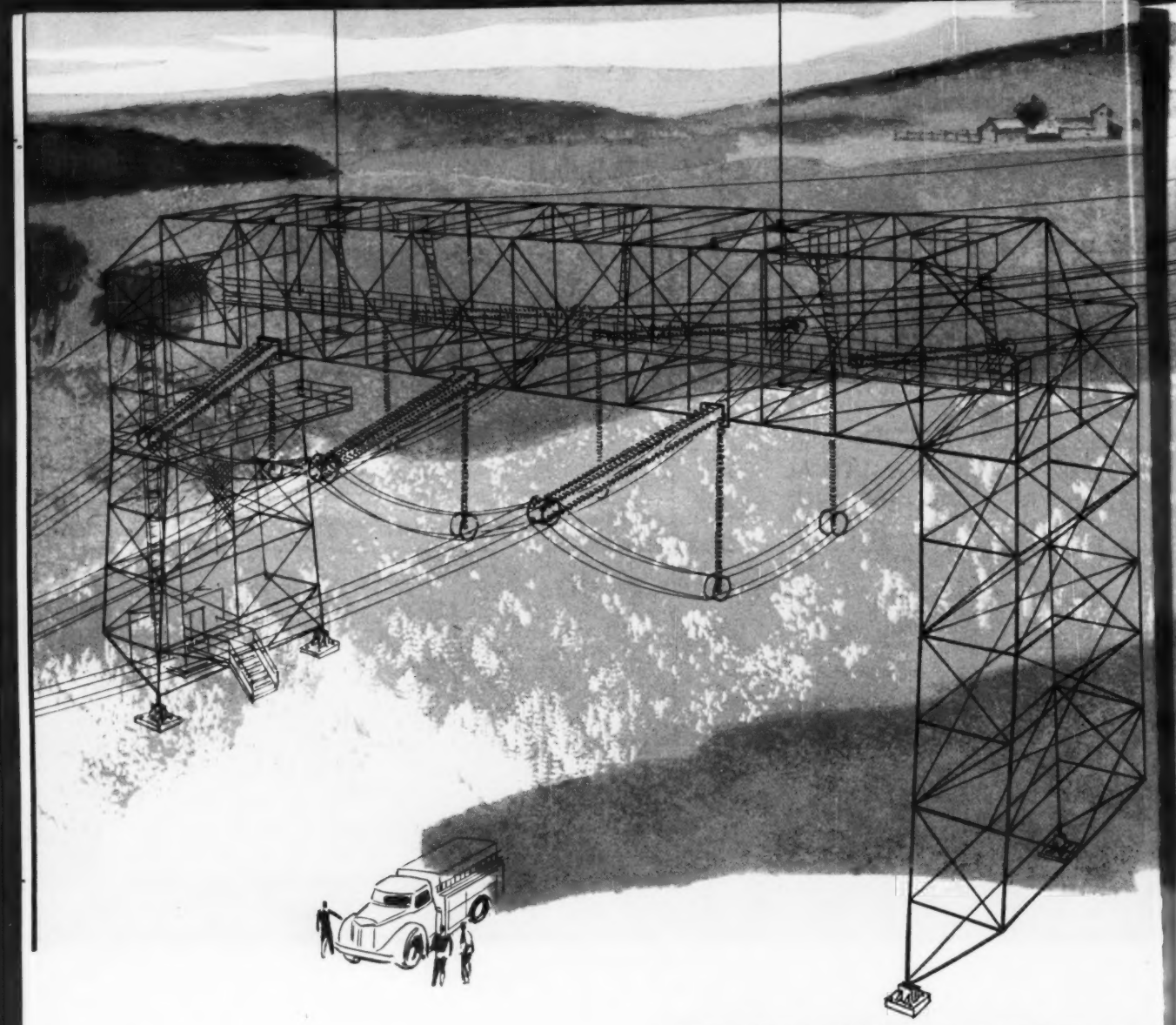
...When it's so easy to overcome the problem

Because the disk and shaft in General Electric watthour meters are suspended *magnetically*, G-E meters (single- *and* polyphase) are virtually unaffected by tilt-caused error —error which *slows down* ordinary ball-and-jewel meters. (The relative spans of calibration change on the above chart show that ball-bearing meters average as much as 2 to 3½% slow at only 8° of "Tilt".) Unique, "free-floating" G-E magnetic suspension can substantially reduce that loss figure you calculated on the opposite page.

For more information, contact your G-E apparatus salesman. Or, write for Bulletin GEA-6683, General Electric Company, Schenectady 5, N. Y.

628-31

GENERAL ELECTRIC

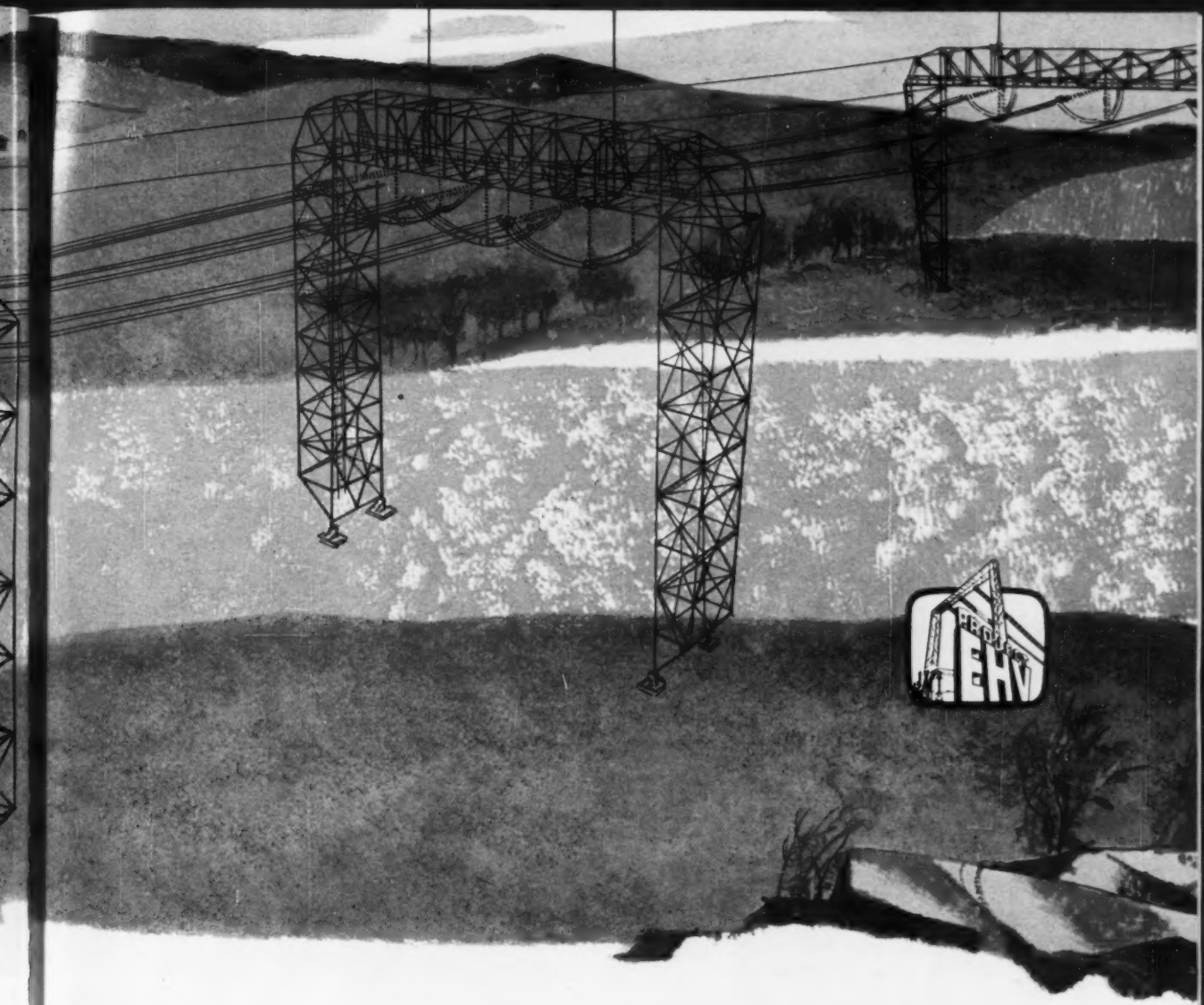


Project EHV power line to

Unique American Bridge portal towers provide maximum flexibility for testing

General Electric is now installing an electric transmission line that will carry a higher voltage than any other line in the world. Known as Project EHV, for extra high voltage, it will be a 4.3 mile prototype power line between Pittsfield, Massachusetts and the town of Lee. Project EHV will be a substantial aid to electric utilities in overcoming the problems and improving the reliability of future high voltage transmission. The line will eventually become a power carrying segment of the Western Massachusetts Electric Company's system at a 600 to 750 KV voltage level.

The project plans call for 18 towers. The first three of these will be large portal-type steel towers 162, 182, and 184 feet wide and 78, 129, and 116 feet high respectively. They were designed by American Bridge Division of United States Steel to permit a wide testing range of all cable configurations. Accordingly, the 4.3 mile line will be split at the third tower and energized from the north end to facilitate these tests. The remaining 3.65 mile section will be energized from the south end. This will be carried by



carry world's highest voltages at 460 to 750 KV

conventional towers—nine of which will also be designed and fabricated by American Bridge.

Unique pin-shoe base. An examination of the soils encountered at the sites of the three portal-type towers, indicated that it would not be possible to design foundations having any dependable degree of base fixity against moments caused by rigid frame action. It was therefore decided to design a pinned shoe at the base of the towers and thus reduce the moments caused by rigid frame action to zero at these points. This reduces considerably the overturning moment on the foundations.

High-strength steel saves weight. The stresses due to dead load, ice, vertical and transverse conductor loads and the effect of transverse wind were calculated on electronic equipment by the American Bridge Division. The tower members are structural tees with about 75% A-7 steel and 25% USS MAN-TEN Brand High-Strength Steel. USS MAN-TEN Steel was used in the higher stressed members of the top and bottom and on the inside faces of the tower legs. The use of MAN-TEN reduced tower weight by approximately 12%.

American Bridge, the world's leading transmission tower specialist, has computed tower designs for the highest voltages likely to be used in the next decade. For recommendations based on your requirements, write American Bridge, 525 William Penn Place, Pittsburgh 30, Pennsylvania.

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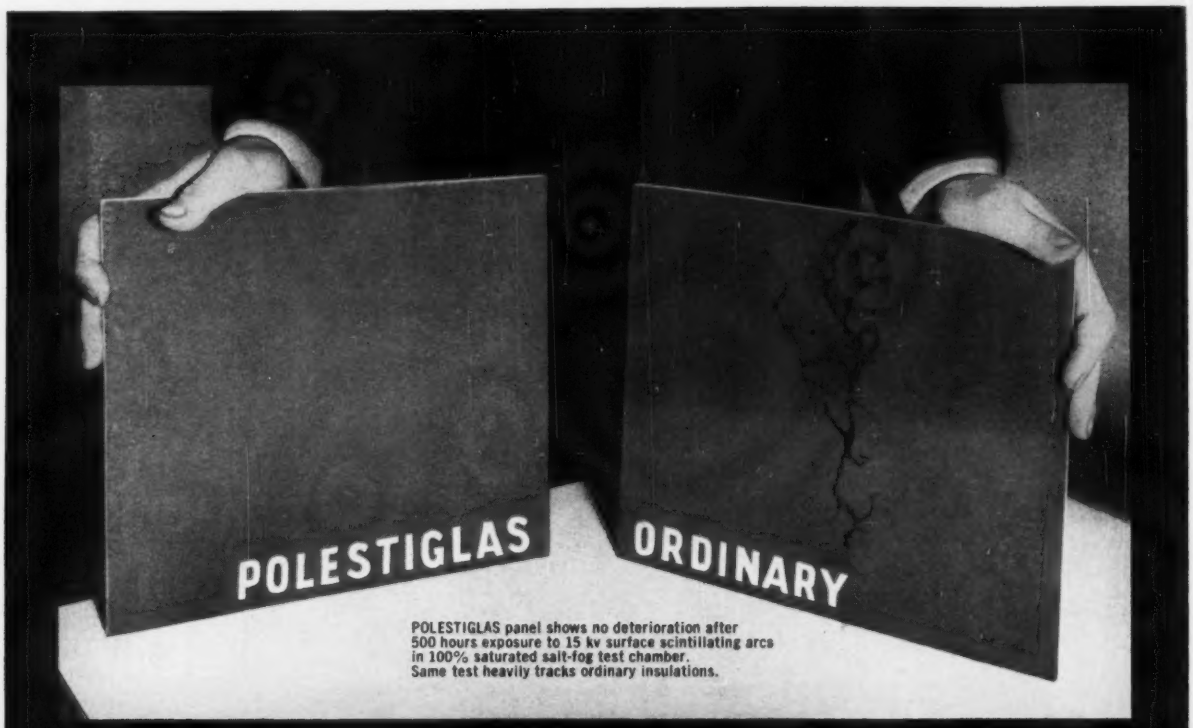

POLESTIGLAS panel shows no deterioration after 500 hours exposure to 15 kv surface scintillating arcs in 100% saturated salt-fog test chamber. Same test heavily tracks ordinary insulations.

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Integral casting of POLESTIGLAS (right) assures uniform bus insulation and eliminates hand-wrapped bends and offsets. Insulation is bonded to the bus bar to give void-free construction resulting in low corona loss.

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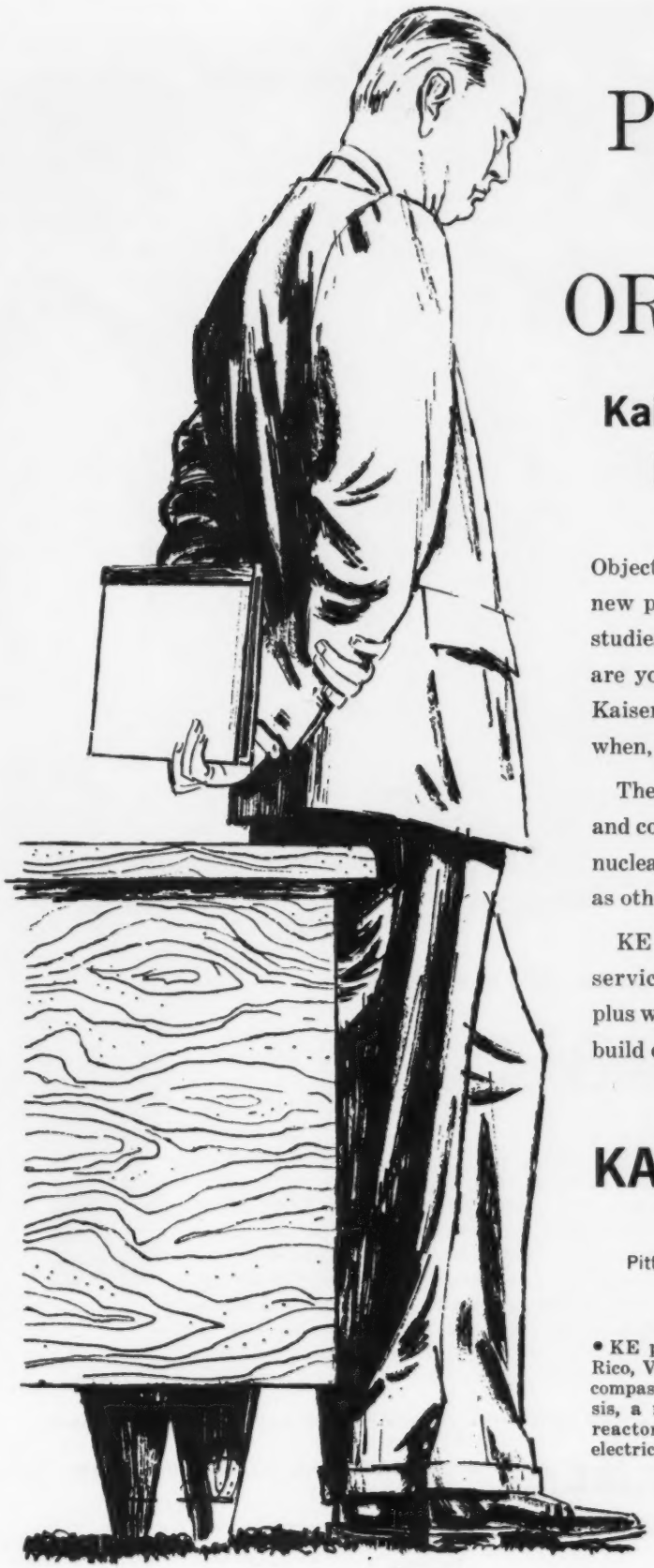
FPE **FEDERAL PACIFIC ELECTRIC COMPANY**

The Best in Electrical Distribution and Control Equipment



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From Lord Kelvin's theory plus practice, more than a century ago, stem today's advances in communications.

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Editorial Comment

DECEMBER 14, 1959

The Utility Is on the Griddle—When the Smoke Clears Away

The seriousness of the appliance servicing problem is pointed up by continued emphasis at industry meetings. Two recent instances are the Southeastern Electric Exchange sales conference, which spent a whole afternoon on the matter, and the Association of Edison Illuminating Companies annual meeting, where industry-wide surveys of approaches were reviewed.

There is general recognition that manufacturers, dealers and utilities share responsibility for lowering the appliance owners' irritation level. According to the surveys, manufacturers and utilities increasingly are facing up to the need; manufacturers, by conscious effort to design more easily serviced products, and utilities, by making sure that adequate, reliable service facilities are located through their areas.

A conclusion could be drawn that the dealer is dragging his feet. This would be unfortunate, for if there is any focal point at which customer dissatisfaction *should* be aimed, it is *logical* that the seller be the target.

Logic notwithstanding, the power company bears the brunt of the customer's ire when an appliance goes on the fritz. Thus many have taken the problem upon their own shoulders and have instituted programs of solution.

Those who have been shirking the issue can do so no longer. Whether they should actually service appliances themselves is a question for each alone. But, for their long-term benefit, they must *see to it* that the situation is covered adequately.

Kitchen Foot-Candles Can Woo Mother to Better Home Light

Since their release last year, the new Illuminating Engineering Society lighting level recommendations have been enthusiastically received and promoted by most utilities.

In the commercial and industrial fields, the number of installations meeting these new standards has been steadily increasing. With ardent education and promotion by the utilities, the prospect for load growth in these areas is promising.

But in residential lighting, most local promotions have not yet caught fire. Even in new construction, the IES minimums are seldom applied.

In our opinion, the key to better residential lighting is the housewife, and the logical starting point, her kitchen. Traditionally the center of the home, the kitchen is still the busiest room in the house. As a basic work area, it needs and deserves good lighting.

Yet it is here that the anomalies of electric living are most glaring. Few housewives today would tolerate an ice box or a hand laundry. Saturation for modern electrical appliances in these areas is high and getting higher. But for lighting, the oldest and most basic electrical "appliance," it is another story. Only a small fraction of even the most expensive housing has the 70 ft-c needed for the mundane kitchen sink or the 50 ft-c recommended for the range and work areas.

Part of the answer to this anomaly is that other electrical appliances have been aggressively promoted directly to America's major buying influence, the housewife. She has repeatedly demonstrated that, once aware of a better way of living, she is quick to take advantage of it.

A long, hard look at promotion aims and techniques might break the roadblock and set up a beachhead for better lighting in the entire home.

Ellis Reviews Tour

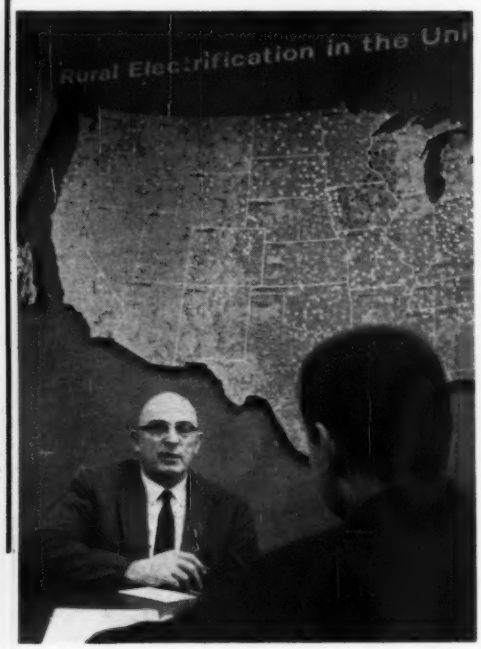
- Russia's rural electrification is weak link in seven-year plan, says co-op group's chief

- Despite de-emphasis, hydro will account for 20% of capacity while U. S. hydro ratio is decreasing under present policies, he finds

Visit Brings U.S. Publicity

The recent tour of U.S.S.R. power projects by a government-sponsored, 11-man delegation (EW, Sept. 14, 1959, p 20), is just beginning to be publicized in the U. S.

One of the members of that delegation was Clyde T. Ellis, general manager of the National Rural Electric Cooperative Assn, who made the tour as a consultant to the committee. In the following exclusive interview, Ellis elaborates on his findings on the rapidly developing Russian power situation.



RUSSIA'S POWER program takes on significance in release of some 60 million people in agriculture to industry, other sectors of economy, Ellis says

EHV LINE from Kuibyshev Dam to Moscow was viewed by delegation. Soviet's 'giant power' approach leads U. S. transmission 'hodge-podge'

Question: *Do the Russians have a rural electrification program for the next seven years?*

Ellis: Yes. Like nearly every other activity in their economy, rural electrification is a part of the seven-year plan. There is apparently a feverish drive on to raise agricultural production and to reduce costs of production. Full electrification of agriculture is considered one of the best ways to bring this about, we were told. Professor Schlekhter, a leading authority on rural electrification in the Academy of Sciences, with whom I talked, stated, "The seven-year plan makes possible electrifying all collective farms in the country and using electricity to mechanize all processes in agricultural production." Schlekhter is one of Russia's top planners.

In my opinion, this goal cannot be achieved by the end of the seven-year plan (1965) but I expect much progress by that time.

What is the status of rural electrification in Russia?

In 1958 about 48% of Russia's 65,000 collective farms had electric power, although a few more had mobile generators providing some current for light, but provided little for power. About 96% of the country's 6,000 state farms were said to be electrified.

These figures could be misleading without further explanation. A state or collective farm with *any* electricity is classed as electrified whether or not all the farm homes are connected. There is a great difference between rural electrification in the Soviet Union and in the U. S. in the *use* of power. The Russians told us that the consumption of power in agriculture in 1955 was only one-seventh that used by American farmers. They add with apparent pride, however, that they are catching up. While their statistics show a steady increase since 1955, we saw little evidence of their catching up with us in rural electrification.

I am sure the entire Senate delegation considers rural electrification one of the weakest links in Soviet agriculture along with a lack of *know-how*, lack of *incentives* and lack of *machinery*, both combustion and electrical.

How does this compare with the U. S. as to miles of line, customers served and percentage of jobs accomplished?

I do not know. However, the miles of line are bound to be small as compared with those in rural America. Historically, Russian farmers have always lived in villages and worked out from the villages on the land. This was just as true when the land was owned by the nobles, kulaks, and small landholders as it is now. Rural electrification, therefore, would require relatively less line in Russia than in the U. S. where each farm home is usually on the land tilled by that family.

I do not know—and if the Russians know they did not so indicate to us—how many rural customers are served, but in my opinion it is a considerably lower percentage of Russia's rural people than her claimed percentage of "electrified" state and collective farms.

The Russian power program for the next seven years, as outlined by I. T. Novikov, de-emphasizes (but does not discontinue) hydro power development. On the other hand, the

# of U.S.S.R.

MOSCOW STOP included visit to air-cooled unit unfamiliar to group. Precast concrete construction techniques are being standardized, visitors learned

program calls for 2.3- to 2.4-fold increase in thermal generating capacity—or 47 to 50-million kw. Newspaper reports from the returning government team appear to emphasize the role of future Russian hydro development. Can you explain this apparent contradiction?

Well, we asked many questions about this. While it may be true that hydro power development is being de-emphasized to some extent, by comparison with the emphasis placed on it in prior years, the matter is entirely relative. Russian officials insisted that hydro power is still being emphasized and that they intend to install 10-million kw of hydro between 1958 and 1965 compared to 7.5-million kw installed in the previous seven years. Hydro power is apparently being emphasized as much as thermal generation. This is borne out by the fact that, by the Russians' own statements, the present ratio of 20% hydro and 80% thermal is to be maintained indefinitely. Power Minister Novikov and others said this.

The importance to the Russians of hydro is further borne out by the fact that construction of Kremenchug Power Dam on the Dnieper River is to be completed one year ahead of schedule; Bratsk Dam—twice the size of Grand Coulee—on the Angara River is to be completed a year or more ahead of schedule; and by the fact that Krasnoyarsk Dam on the Yenisei, to be about three times the size of Grand Coulee, *is* being started.

This is in contrast with the fact that the percentage of hydro power in the U. S., presently about the same as that of Russia, is destined to decrease, unless the Administration's "no new starts" policy is overturned by Congress, or far more non-federal hydro development is undertaken.

We have been told by responsible Russian power engineers that they expect hydro to stabilize at about 20% of their total generating capacity. Does this agree with your findings?

Yes. This agrees with what Russian officials told us.

Did you find any inclination on the part of the Russians to increase the level of fossil fuel production?

If you mean "fossil fuel production of electricity," my reply is that whereas the Russians are building thermal capacity like mad, just as they are building hydro capacity like mad, we did not find any inclination on their part to increase fossil fuel production over the percentage by which hydro production will be increased.

If you mean the *amount* of fossil fuel production, my reply is that we detected no indication that thermal plants would be built and left standing idle. Therefore, one would assume, I think, that fossil fuel production is to be increased as needed.

We did hear several reports of vastly increased oil and gas production. We also heard of campaigns to induce people to cook with gas.

In view of your trip, what recommendations does the group—or you—have for changing the U.S. pattern of development?

The 11-man Senate committee delegation has not released any recommendations as yet, so I can speak only for myself.

My particular assignment by the chairman of the delegation, Senator Moss, had to do with relating Russia's electric power development to agriculture. I can say that since somewhere between 42 and 50% (depending upon the definition used) of Russia's population is engaged in agriculture, as compared with 10 to 12% in the U.S. and since Premier Khrushchev is pressing hard for vastly increased agricultural efficiency and for the consequent release of some 60 million people from the land to industry and other sectors of the economy, and since complete rural electrification would be one of the principal factors in achieving this efficiency, her fantastic power program takes on great significance.

The Russians, because they can direct absolutely the patterns of their society and the courses of their economy, will be able to maximize the efficiency of their river potential and the efficiency of their total electric power system including rural electrification.

For instance, they are able to develop the full potential of a river without wasting, let us say, half the power potential of a dam site such as we are doing in Hells Canyon. They are able to tie together, as they are doing, their total electric system with gigantic transmission lines roughly twice the size of most of what we have. It seems to me to follow, as the night the day, that the U.S. can no longer tolerate waste of resources or any lack of electrical efficiency. I do not suggest and I do not believe that the Russian type of state capitalism (or communism, if you will) should have any monopoly on the means of achieving such efficiency.

For instance, in Western Europe, many countries are interconnecting

BRATSK DAM construction continues even in 50 deg below zero. Power Minister Novikov developed precast building methods that speeds project work

not only their own total power production capacity with giant transmission lines, larger than ours, but, also, those of their neighbors. Both Russia and the Western countries are ahead of the U.S. in this area of what has been referred to as "giant power." We, too, must come to it quickly, in my opinion, as a substitute for the hodge-podge of smaller stuff which in many sections of our country is *inefficiently tied together in makeshift arrangements.*

Russian atomic experts who were in the U.S. recently said that the Soviets will have 600 *Mw of nuclear generation by* 1959-65. *Can you give us more details on these reactors as to type: boiling water, pressurized water, gas cooled, fast breeder, etc.?*

No. While we were told this too, we did not seek to visit atomic plants and we did not press the Russians for facts in the atomic field. This must not be taken to indicate any lack of interest on our part in this area but our assignment was primarily in the field of hydroelectric power and its impact upon the economy. Our 31 days in Russia simply were not enough to allow us to include the field of atomic power, too.

How far behind are the Russians in the nuclear power field?

I did not gain the impression that the Russians are trailing the U.S. in the nuclear power field. I understand they produced atomic power commercially before we did.

We have been told that the Russians are using prefabricated concrete panel construction extensively in their new power plants. Did you see any of this?

Yes, we saw much of the Russian's precast concrete form and section construction on hydro electric projects. It was largely because it is faster, we were told, that Bratsk Dam will be completed one to two years ahead of schedule and Kremenchug one year.

The chief of construction of Kremenchug Dam told us that the in-place cost of concrete, using the precast form technique, would be approximately 65% of that using wood forms. The concrete heating techniques and the techniques for tying these blocks together with a minimum amount of pouring concrete also permit them to continue building throughout the winter months no matter how cold it gets —and we were told that it gets as low as 50 deg below zero at Bratsk. They claim that 40% of their concrete is placed during subfreezing weather.

We were told that Mr. Novikov himself is one of the geniuses who developed this precast system and this may be a principal reason he is Minister of Power today. He was previously chief of construction at Kremenchug Dam and we were told that Kremenchug represented the latest techniques in pre-formed concrete block construction. We were also told that this method is being standardized using six types of blocks.

Did your group get to see everything it hoped to? If not, what items of interest to the group were excluded, either by the Russians or by other reasons?

Yes, generally so. We saw several types, sizes and stages of hydroelectric projects. We saw one being constructed in a mountain. We saw projects that depend largely upon flood waters. We saw projects just completed and still in progress on the Volga, the Don and the Dnieper, two of them larger than Grand Coulee in kilowatt capacity. We saw the giant Bratsk project, twice the size of Grand Coulee, under construction. We wanted to see the site of the still larger Krasnoyarsk project where only preliminary work has begun. We wanted to see it largely because it is to be three times the size of Grand Coulee. We didn't get to see it.

We saw one thermal plant. We saw the Russian generator works, "Electrosila," at Leningrad. We saw the various design and testing institutes, and in this connection we got a real break. One of the top Russian officials who was with us for three weeks had just returned from a two-year assignment in China. He told us in great detail about the Chinese program, of some 250 dams under construction including the giant Yangtze River project which, in terms of capacity, will be some 13 times the size of Grand Coulee.

Do you have any comments on the information made public by earlier U. S. power delegations to Russia?

Well, it had seemed to me from what I have read and heard of their reports that the so-called private power company officials who visited the Russian hydroelectric and other projects on two occasions in the past two years must have been seeking arguments against hydroelectric power development. It was interesting also that they apparently presented themselves to the Russians as officials of state franchised public service electric power companies. If they would present themselves to the U. S. as such and act accordingly, I think we would have more power development, more efficient development and cheaper power.

What were the most important Russian power developments in your opinion?

I am not clear as to what you mean. If you are referring to projects, then I would list the Krasnoyarsk and Bratsk developments in Siberia and the Kuibyshev and Stalingrad projects on the Volga, largely

(*Continued on page* 109)

Steel Strike Hits Utilities' Spending Plans

First quarter will be 4% below last three months of 1959, a year when total public utility outlay will hit $5.7 billion

The carryover effects of the steel strike are being felt by public utilities, forcing some delays in construction.

This is the interpretation you can draw from the latest quarterly survey by the Commerce Department and the Securities & Exchange Commission on business plant and equipment spending plans. In addition to delays due to uncertainties over steel deliveries in the closing months of this year, utilities are scheduling first quarter spending plans 4% below expenditures for the last three months of 1959.

First quarter capital spending is now figured at almost $5.6 billion on a seasonally adjusted annual rate basis—down some $220 million from the October-November estimated rate.

For the year 1959 as a whole, the SEC-Commerce survey now estimates public utilities will have spent $5,745 million. Total spending by all industry is computed at $32.6 billion.

Utilities are by no means alone in feeling the delayed effects of the strike. Most industries are being forced to rein in on spending plans. Electrical machinery and equipment manufacturers and producers of nonferrous metals are planning only very slight increases in capital spending next quarter.

Manufacturers' Outlay Rises

For the electrical machinery groups, total first quarter spending on an adjusted rate basis is ticketed at $540 million, an increase of $30 million from the previous quarter. Total 1959 spending is estimated to run around $503 million.

For nonferrous producers, the adjusted first quarter rate is up only $10 million from the October-November-December period to a total of $370 million. Total 1959 spending for these firms now is figured to hit $320 million.

For industry as a whole, the SEC-Commerce survey predicts a modest quarter-to-quarter increase of $450 million to a rate of $34.4 billion. On this basis, Administration economists now forecast spending of around $37 billion for the year, which is in line with latest survey of the McGraw-Hill Department of Economics.

To reach such a figure would require a strong pickup in capital spending programs during the last nine months of 1960. Even so, it is still a question whether the reductions in plant and equipment additions stemming from the steel strike can ever be made up completely.

Any resumption of the steel strike in January would, of course, further disrupt industry expansion plans.

Faulty Circuit Breaker Darkens Kansas City, Mo.

About 100,000 of Kansas City Power & Light Co's 260,000 customers were affected by a 50-minute outage on Dec. 4 when a circuit breaker failed to function after a 13-kv cable shorted. The fault occurred in a transformer substructure near the company's Northeast power plant.

The 161-kv transformer's oil exploded and there was a brief blaze which burned itself out. The explosion and fire apparently occurred in the coolant-oil line which broke under pressure, said Charles H. Monnier, executive vice president. The released oil caught fire in the resultant flashing he theorized. Doors on both sides of the small terminal building blew off, but there were no injuries.

The interruption took place when the company was carrying a 500-Mw load on its system. All of the Northeast plant's 180-Mw capacity was lost and some 20 Mw was shaved at another plant when the system dropped to about 57 cps.

Temporary help came over tie lines from Union Electric Co and St. Joseph Light & Power Co, but Kansas City P&L's remaining 640-Mw capacity was more than ample to ride through the loss of Northeast.

The outage hit the Missouri side of Kansas City's downtown and industrial district. Some stalled elevators, traffic jams, and airplane traffic interruptions resulted. Immediate damage to the utility equipment was estimated at from $40,000 to $50,000. A General Electric Co representative was sent to assess the damage and ascertain the cause of the blackout.

A delegate of the U.S.S.R. basketball team shrugged off apologies for the disruption of a Hotel Muehlebach reception. "Things like this happen in Russia, too," he said.

EXPLOSION blew doors off terminal building but caused no injuries. Coolant-oil line of transformer broke under pressure, it is believed

New York State Nuclear Office

Office of Atomic Development might give $1 to $2 million towards nuclear plant R&D costs. It may serve as a model that could affect electric power companies in other states

New York State made its bid last week for a bigger share of the country's atomic energy business with announcement of the first solid plans of its new Office of Atomic Development. Its recommendations carry broad implications for utilities in other states.

The scheme: to supply cash for certain research and development projects, search out sites for nuclear installations, promote atomic progress within the state. In short, the agency hopes to act as a catalyst, attracting new atomic business by providing a healthy climate for nuclear development.

Behind this lies New York's desire to hasten the day of low cost nuclear power for the state, an area of relatively high fuel costs.

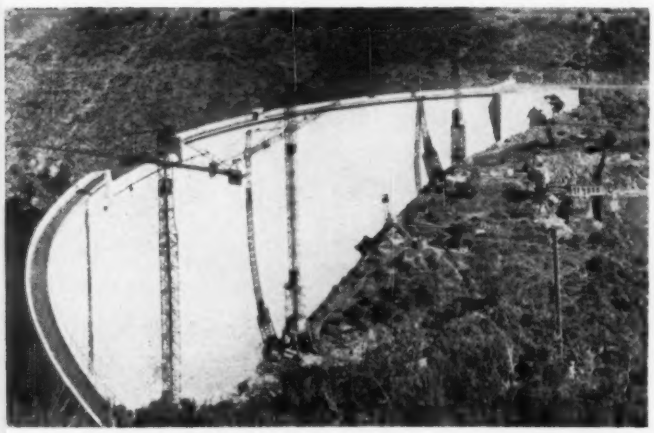
In a 56-page report to Gov Nelson A. Rockefeller the agency urged that New York share development cost with the private electric utilities, perhaps running into the millions, for a full-scale atomic power plant. Also that it should provide up to $1 million to universities on a matching basis to build nuclear training facilities for students.

TOWNSEND: A catalyst action

Both these major recommendations will have to wait, at least for the time being. While writing the group's other proposals into a bill, Rockefeller chose to hold back on any recommendations to put state money into a nuclear power plant. First, he wants to see the final report of his Committee on Power Resources, soon to be published. Colleges, too, will have to wait for the $1 million the New York office would like to see them get. Rockefeller first wants some clear evidence that money New York has already put into similar programs was well spent.

The state's atom program really got rolling in March, when the Atomic Development Office was formed. That month New York took a big step to encourage atomic development when it voted to share construction costs for a nuclear training center at the University of Buffalo. New York put in $1 million of state money, the university $1,050,000 that it raised privately. The money will finance a new center that will include a 1,000-tkw modified boiling-water research reactor, two small accelerators and a hot-lab.

Back of this activity stands Oliver Townsend, director of the state office. Townsend heads up an agency that is said to be the most extensive yet tried by any state, an agency that may serve as a model of its kind for other states. It could be an important model. The Atomic Energy Commission is just beginning to turn over some of its closely-held duties to state control, and there are bound to be more of these state groups in the future. They will all affect the nuclear power industry. Three other states



MALPASSET DAM, designed to hold 13.7-million gal for irrigation purposes, was completed in 1954 for $1.1 million. Structure was 22.6 ft at base and 4.9 ft at top

Investigation Begins on

The French government has named a team of experts to probe the causes of the worst dam disaster in French history. The group will seek to discover if the prevalent theory that a shift of the rock structure supporting dam foundations on the left bank caused the rupture of the arch-type Malpasset Dam Dec. 2.

More than 370 persons died when some 13-billion gal of water broke through the 196.8-ft high irrigation dam and rushed through Reyran Valley, 16 miles southwest of Cannes, and levelled large sections of Frejus, a town of 13,500 population.

The investigation team, led by Didier-Oliver Martin, director of equipment for Electricite de France, and Joseph Duffaut, chief of the large dam section, Ministry of Industry, will not release its report until January at the earliest. Engineers in Paris backed the theory of the rock-structure shift by noting that bearing points on

Set to Attract Atomic Power Plants

have already provided for full-time nuclear coordinators, and 13 other states have voted to create special part-time atomic commissioners. Probably no state has gone as far in this direction as New York.

Former AEC Men on Staff

Townsend heads up a staff of nuclear experts, all full-time professionals, all former AEC men. Townsend himself was assistant to the late Gordon Dean, former AEC chairman. The three other members of his agency: Jon D. Anderson, deputy director; David N. Bressler, staff counsel; and Robert Vessels, health physicist.

Together they will wrestle with a big problem. To date, the nonweapons sector of the atom industry —now doing about $150 million worth of business each year—has not been seeking out New York as a principal site.

Private industry's share of the roughly $3 billion spent annually on atomic development is small. But the bulk of the money private companies are throwing into atomic research and development is being spent in anticipation of a huge future market. A market that New York and other states may miss out on if atomic development is not encouraged at the outset.

Running high on the office's list of projects is a waste disposal site within the state. This would serve two purposes: to attract fuel reprocessing industries—the major source of radioactive waste—and to encourage other atomic projects in New York, primarily more atomic power plants.

Presently, radioactive waste is disposed of at AEC sites in Idaho, South Carolina, Tennessee and Washington after reactor fuel is reprocessed. Big future demands on these AEC facilities means they will have to be enlarged. But once this expansion of AEC facilities takes place, private entry into the fuel reprocessing business may be postponed, conceivably for good. Townsend therefore believes that states must work fast while there is still time. He hopes to have a New York disposal center working within two years, at the latest, when Consolidated Edison Co's Indian Point plant goes critical.

New York is fortunate in this respect—it has one of the only really big salt formations in the Northeast. Some 10,000 sq miles of salt beds and salt domes are in its southwestern section at depths of 800 to 3,500 ft. Salt formations like this are the best known dumping grounds for radioactive waste.

New York expects to spend $147,000 for disposal site surveys, and the first survey parties will probably set out next spring. There may be mine shafts near large salt formations, Townsend said. If so, a state disposal site could be established for a few hundred thousand dollars, he told Electrical World.

Townsend's group is anxious to see another power reactor in New York to complement the plant already going up at Indian Point. New York might be willing to share the R&D costs of such a project with private utilities if the plant gave reasonable hopes of turning out near-competitive nuclear power, the report said.

May Share R&D Costs

How much would the state be willing to contribute to a second power plant? Anything less than $1 to $2 million at a minimum would not be much inducement for private industry to commit itself to that kind of job, he said. But the state funds would not be payable until the reactor was completed.

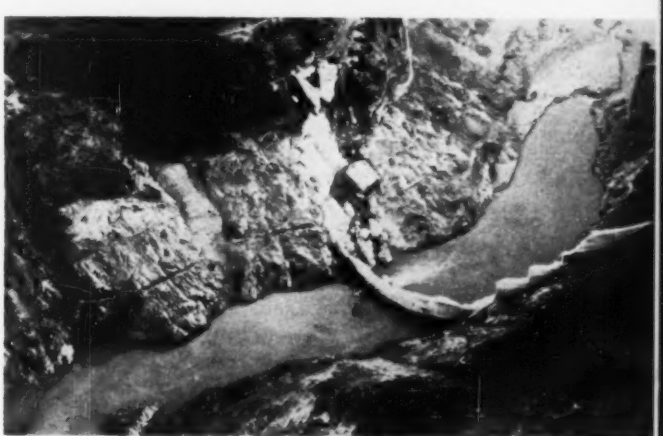
Safety inspections under the agency will be confined entirely to radio-isotopes, not to power reactors. The federal government holds a monopoly for regulating atomic power plants and the New York agency is not equipped or anxious to move into this field for some time. However, the office has backed legislation that would give states the right to approve sites for atomic power plants.

Cause of Dam Rupture

either side of arch dams are points most susceptible to failure. Should one carry away, the arch could break anywhere. This, they say, accounts for reports that the break started near the center.

Construction of the arch itself was discounted by these engineers as a cause of the break. The step-like fracture of the right bank's stub follows outlines of poured sections, indicating the break was along lines of least resistance after the foundation shift, not that joints between poured sections were defective.

The dam was a Ministry of Agriculture project completed in 1954 with the guidance of Andre Coyne and Jean Bellier. The $1.1-million structure had a thickness of 22.6 ft at the base and 4.9 ft at the top. EDF engineers indicated the disaster had not occasioned any lack of confidence in its Gage Dam which, with 4.3-ft thickness at the top, ranks as the world's thinnest.



CAUSE OF BREAK may have been because of shift of the rock structure supporting dam foundations on left bank. Team of experts to determine the cause of rupture

Management Reviews Progress In E

Better informed public is key factor in meeting rate adjustments. More active interest in politics urged for American business in facing threats to free enterprise. Improvement in rate base and rate of return regulation necessary to make utility earnings commensurate with unregulated industry, speakers tell meeting of Association of Edison Illuminating Companies, November 9 to 11, 1959

The President's Address

WALTER C. BECKJORD, President, Association of Edison Illuminating Companies and Chairman of the Board, Cincinnati Gas & Electric Co

Enactment of the TVA revenue bond financing bill is "the greatest victory won by the advocates of public power in the last quarter century," said President Walter C. Beckjord, chairman of the Board of Cincinnati Gas & Electric Co, in his opening address to the Association of Edison Illuminating Companies. He called on the industry to face up to the progressive encroachment of government.

"This legislation could be a long first step toward unlimited expansion of its (TVA's) service area and operations," Beckjord observed. "With the granting of authority to TVA to issue revenue bonds, it will probably be only a short time until other government-owned power authorities will seek similar rights."

In the face of such threats to the free enterprise system, Beckjord said, some better means must be devised of informing the public.

"It is in this respect that American industry is being confronted with the inescapable duty to take an active and vigorous interest in politics." Beckjord said.

Beckjord observed that corporations are prohibited from spending company time and money on the promotion of individual candidates or political parties. "But," he said, "all employees and others interested in the welfare of American business should receive every encouragement to work for and contribute to the political party of their choice. They should become identified as supporters, at the precinct or grass-roots level, of those candidates who best represent their personal point of view. As such, they can exercise an important influence toward the selection and advancement of men of sound and independent judgment in both parties."

In the matter of rates, too, Beckjord urged the need to inform the public. Despite management and technological achievements in holding down costs, the gap between the rates of subsidized power and business-managed utilities has been widening, he said.

"Our rate program should include increased efforts to tell our story to the public. Certainly people will understand that our industry alone can no longer hold the line on prices."

"Utilities still have a firm obligation to earn a fair return for investors. To insure that return the industry must seek increases when and where warranted, early and vigorously."

Beckjord urged that strenuous efforts be devoted to improvement in rate base and rate of return regulation, to the end that earnings may be truly commensurate with those in unregulated industry.

He called on the industry to use every possible means to overcome the reluctance of regulating bodies to relax overly-restrictive regulations on earnings.

"I am fearful," he said, "that many regulatory commissions are fixing the level of earnings only by comparison with what other utilities are earning, and not with what they should be earning."

Improvement in Fair Rate of Return

JOHN F. CHILDS, Vice-President, Irving Trust Co

"What would have happened to your utility industry if it had been forced to increase its rates, like other industries have increased their prices, over past years?"

"You'd have been in sad financial shape!"

"Actually you've been living in an economic paradise because the nature of the electric utility industry has made it possible to hold the rate line. But as a consequence, the rate situation may be a bigger problem in the future than has been apparent in the past."

In such direct and forceful language as this John F. Childs warned industry executives of possible impending rate difficulties.

Among Childs' forthright recipes for approaching the future rate problem were these:

- "Don't search for a "new approach" to show the need of a fair return. There may not be any. Bear down on improvements to the traditional approaches."
- "Don't permit legal council to approach rate matters primarily as a legal situation. Remember that rates

Engineering and Sales at AEIC

are principally an economic matter. Insist that company lawyers understand the economics."

• "Don't treat rate cases as a battle of strategy! Develop strong principles and stick to them. You'll be better off in the long run."

• "Assign an aggressive young executive to full-time duty on economics and rate cases. Let him study, and actually watch other companies' rate cases in action. Encourage him to prepare his own cases a year in advance. Charge him with responsibility for preparing the public from the very beginning."

Joint Report on U. S. Tour of Soviet Power System

EDWIN VENNARD, Managing Director, Edison Electric Institute

WALKER L. CISLER, President, The Detroit Edison Co

U. S. power experts toured Soviet Russia for ten days during the summer of 1959 to inspect electric power system installations and facilities for the manufacture of electrical apparatus. The visit, arranged by the U. S. State Department, and under the auspices of the AEIC and EEI, was the second such tour in two years to be made by U. S. power men under similar sponsorship.

The 1959 tour differed from the previous one. It covered more than twice the distance, embraced different areas, plants and facilities and included the tremendously potential area of eastern Siberia.

Observations and conclusions drawn from the tour and reported jointly by Messrs. Cisler and Vennard were these:

• Soviet generating capacity was about 48 million kw last year. They've added 5.5 million more this year. They project a like amount next year.

• On the first trip participants were told that Russian atomic work was not sufficiently advanced for visits. This time we were permitted to see two nuclear projects.

• The Soviets build spectacular hydro plants. Our teams saw many of them. But the Soviets are finding that hydro developments are costly, and take longer to build than equivalent steam capacity.

• Despite an undeveloped potential of 20 million kw of hydro in the USSR, the Russians are backing away from their emphasis on this type of capacity in favor of steam-electric plant construction.

• Though the Russians have missed the capacity goals of their construction programs by as much as 10-20% in the past, we must now assume they will achieve the goals of their new seven-year plan.

• Poland, visited by three U. S. team members, has 5.5 million kw of generating capacity. Their power system employs 54,000 people.

• A detailed report of the Soviet tour, prepared primarily for presentation before the Subcommittee on Economic Statistics of the Joint Economic Committee of Congress has been issued by Edison Electric Institute.

• The recent reciprocal visit of Soviet power engineers to the U. S. is very important and will do a tremendous amount of good. We in the U. S. don't yet realize the importance of these visits and the vital need to increase mutual understanding. It is just as important to us as to maintain our defenses.

Dollars and Sense of Electric House Heating

C. W. BARY, Economic Analysis Engineer, Philadelphia Electric Co

"To make electric house heating in the long run an economically desirable business, attractive to potential users, the following actions are required now by the electrical industry:

• Establishment of criteria for a high degree of house insulation with electric heating.

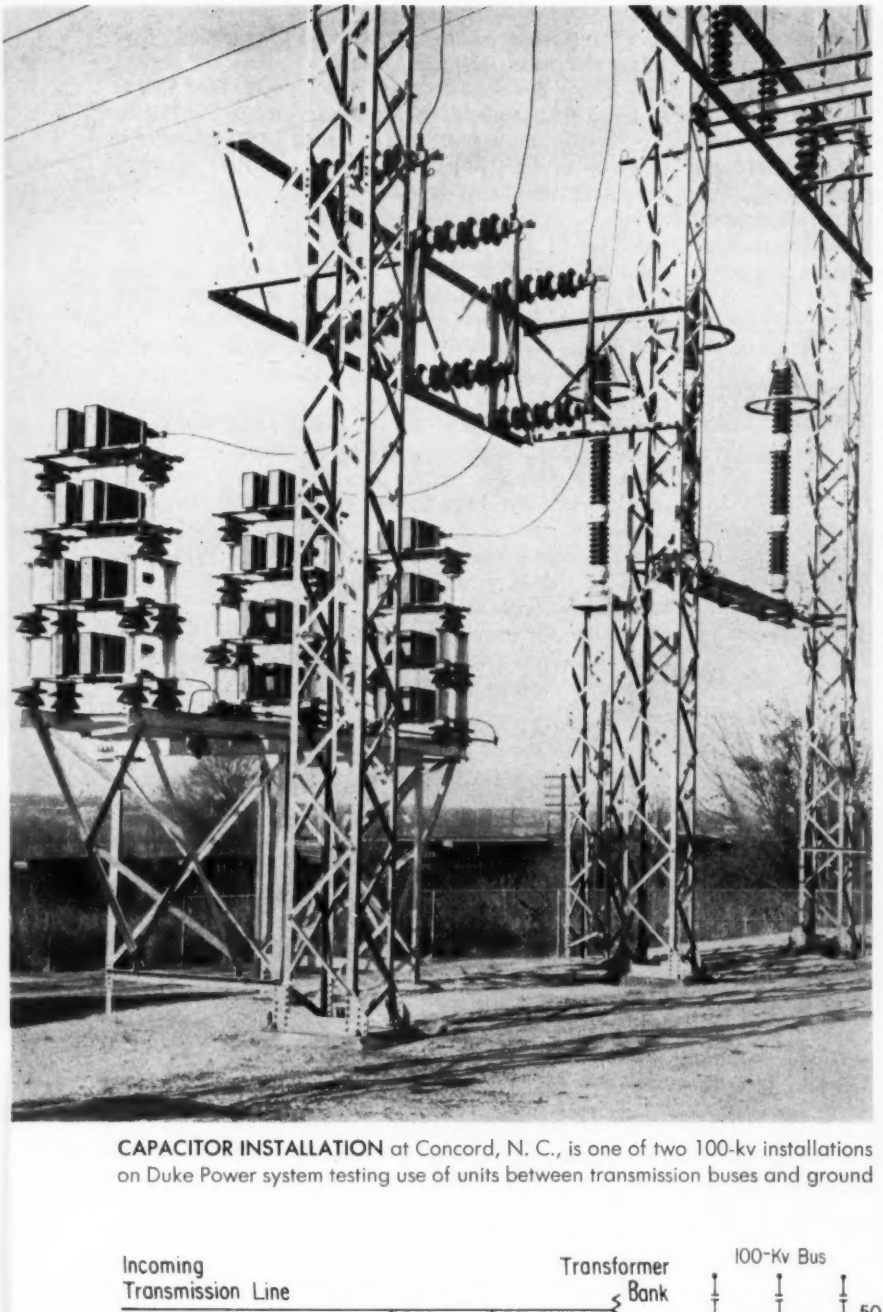
• Direction of efforts by manufacturers toward improving the annual heating COP (coefficient of performance) of heat pumps into the region of three or more.

• Stimulation of research and development efforts by manufacturers and utilities to find, design, and apply practical heat storage systems for use in conjunction with electric heating installations.

• Establishment of kilowatt-kilowatthour rates for residential customers using electric house heating, with self-acting incentives to compensate users for the added

(*Continued on page 59*)

Capacitors Limit Line Surge



CAPACITOR INSTALLATION at Concord, N. C., is one of two 100-kv installations on Duke Power system testing use of units between transmission buses and ground

Tests by Duke Power show units between transmission substation buses, ground permit lower transformer BIL

HERMAN B. WOLF, Manager of Operations, Duke Power Co, Charlotte, N.C.

The basic insulation level of power transformers can be lowered by installation of capacitors between transmission substation buses and ground. Test results of four Duke Power Co installations, two on 100 kv and two on 44 kv, show that such an arrangement is practical for absorbing surge energy of traveling waves from transmission circuits. An important contributing factor is that 50-kvar and 100-kvar capacitor units now are available.

Because of lowered BIL, equipment costs can be reduced and efficiencies raised. Other than these economic benefits, the advantages of capacitor protection for substation equipment appear to be these:

- Instantaneous response to all surges regardless of wave shape or magnitude.
- Protection is assured at all times. As current flows continuously in the capacitor circuit, this flow may be monitored or checked periodically.
- Complete protection is provided when the capacitor assembly is equipped with solid backup gaps which function in the event of a direct lightning stroke to the station or to a line in close proximity.

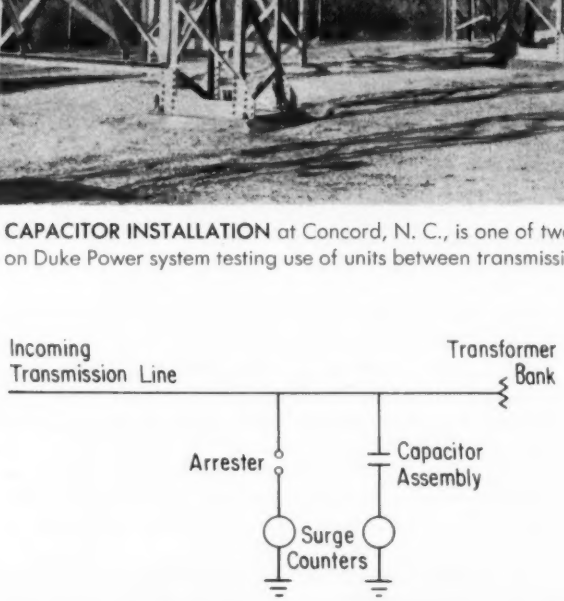


FIG 1—CAPACITORS in diagram are set up to absorb surge energy of traveling waves from transmission circuits

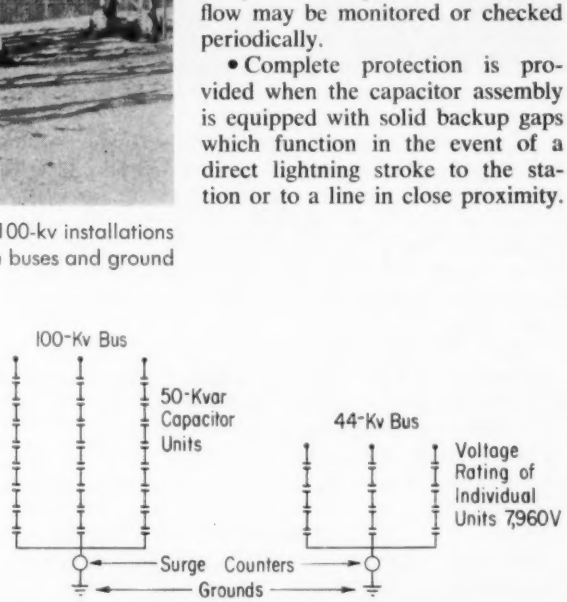


FIG 2—SCHEMATIC compares capacitor installations on 100-kv and 44-kv buses at transmission substations

Peaks

Experience from the arrester performance indicates that 6-in. gaps on 44 kv and 12 to 13-in. gaps on 100 kv are enough.

• Capacitors are not damaged by switching surges. But capacitors do not limit the voltage rise caused by a long wave as effectively as they do those caused by the shorter lightning surges.

To acquire the most experience in the shortest time, the test installations were placed on substation buses having a single incoming line over 20 miles long connected to a transformer bank—a point of maximum reflection. A single series string of 50-kvar capacitors was used from phase to ground. To compare the effectiveness of capacitors as protective devices, a modern station type lightning arrester was installed in parallel with the capacitor installation. Surge counters were inserted in the ground circuit of each capacitor neutral and in the ground circuit of each arrester. Fig 1 is the schematic diagram of the test installations; Fig 2 that of the capacitor installations.

Calculated voltage rise when a 700 kv, 0x20-μsec wave is applied to the capacitor installation is shown by the curve in Fig 3.

While the single series capacitor strings gave a certain reduction in crest voltage of the incoming surge, further reductions can be obtained by larger capacitor units and by one or two or more units in parallel. Table I shows the crest voltages that may be expected with single, two, three, and four parallel strings of 50-kvar capacitor units. These data indicate that voltage crests can be held to almost any desired level.

The field performance of the test installations is shown in Table II. The counter readings include the period from the date of installation to September 1, 1959, or two summers' operation.

As for station protection, capacitors and racks cost somewhat more than station type arresters. But if credit is given for the application of capacitance to the system, the cost of capacitor protection is comparable to or lower than that of arrester protection.

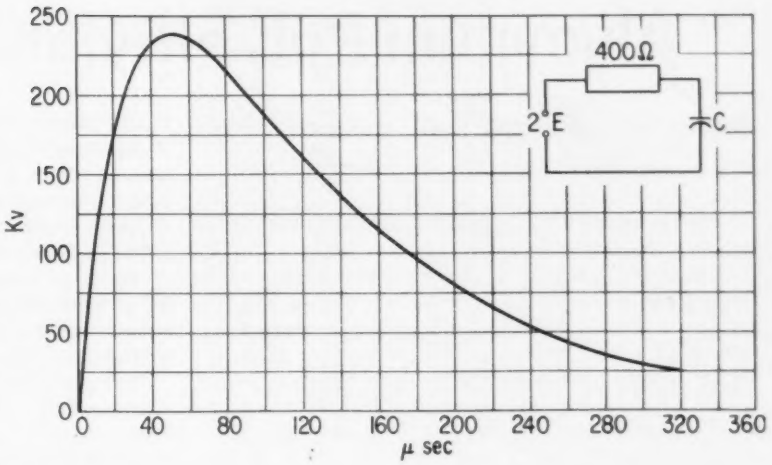


FIG 3—CURVE shows calculated voltage rise of 700-kv surge, 0 x 20 μsec wave when applied to the capacitor installations at Duke Power transmission stations

Table I—Summary of Voltages in Substation

100-Kv Substation
Magnitude of Incoming Surge—700 Kv
Wave Shape of Incoming Surge—0 × 20 μ Sec Wave

50 Kvar. 7,960 V Capacitors per Phase No. in Series	No. of Parallel Strings	Total Capacitance Per Phase—μf	Time to Crest Voltage—μf	Crest Kv
8	1	0.261	51.4	237
8	2	0.522	66.3	141
8	3	0.783	75.8	101
8	4	1.044	82.8	79

44-Kv Substation
Magnitude of Incoming Surge—350 Kv
Wave Shape of Incoming Surge—0 × 20 μ Sec Wave

4	1	0.522	66.3	70
4	2	1.044	82.8	40
4	3	1.566	93.2	28
4	4	2.09	100.6	21

Table II—Comparison of Arrester and Capacitor Surge Counter Readings from Installation to Sept. 1959

	Location	Date Installed	Capacitors 1958	Capacitors 1959	Arresters 1958	Arresters 1959
100 Kv	Concord	6-14-58	127	79	0	0
100 Kv	Pinnacle	6-20-58	287	185	0	0
44 Kv	Linden St	5-25-58	84	213	0	0
44 Kv	Old Fort	9- 7-58	7	132	0	0

Aluminum-Polyethylene Cable Saves

Phase and ground fault current curves were included in cable specifications

J. J. **JACQUIN**, Engineering Dept, The Dow Co, Freeport, Texas

The Dow Chemical Co has saved more than $400,000 in cable costs alone plus appreciable savings in installation costs by using aluminum polyethylene aerial cables for 15-kv power distribution systems at plants in Texas and Louisiana. Since the first installation of aluminum-polyethylene was made late in 1956, 431,000 ft have been installed in Dow's plants.

Insulated aerial cable distribution has been used since the initial installation in 1941. Compared with open wire:

1. It provides virtually foolproof protection from lightning and associated outages. This protects both the generators, which are tied directly to the 15-kv feeder buses, and the distribution system from serious damage.

2. Corrosion and contamination are minimized. The chemical atmospheres at the Gulf Coast location of these plants would produce severe problems with insulators and hardware if open-wire construction were used.

3. Space is at a premium, Fig 3, and aerial cable construction requires less space for distribution of the heavy blocks of power required. With aerial cable, a typical structure of two poles, spaced 10 ft apart with three crossarms with 30-inch vertical separation, offers space for 18 separate 3-phase circuits. The limiting factor is the horizontal loading for cross winds of hurricane force.

4. Aerial cable circuits are safer than open wire around plants of this type. Maintenance work is easier and more economical. Best example of this is the marked labor cost reduction in the painting of steel towers when conductors are insulated.

These advantages dictated use of aerial cable for 15-kv distribution to meet the engineering and economic requirements and provide the service reliability essential to a continuous process industry.

Although cables used in early installations in Dow's Texas plants were the best available at that time, it became apparent in 1952 that their performance was below expectations. These cables were of copper, varnished cambric insulated, shielded, jacketed, bronze armored construction. Sizes ranged up to 700 MCM in 3-conductor types and to 2,500 MCM single-conductor. Records showed that a large percentage of the failures could be attributed to moisture penetration into the insulation.

Cable insulations of rubber, paper-lead, and polyethylene compounds were evaluated in the light of:

1. Electrical insulating characteristics.

2. Resistance to severe atmospheric contaminants and moisture.

3. Availability at reasonable cost.

4. Performance and longevity under operating conditions, including thermal, mechanical, and dielectric stresses.

5. Simplicity of installation, including splicing and terminating.

If possible, an extruded insulation was desired to

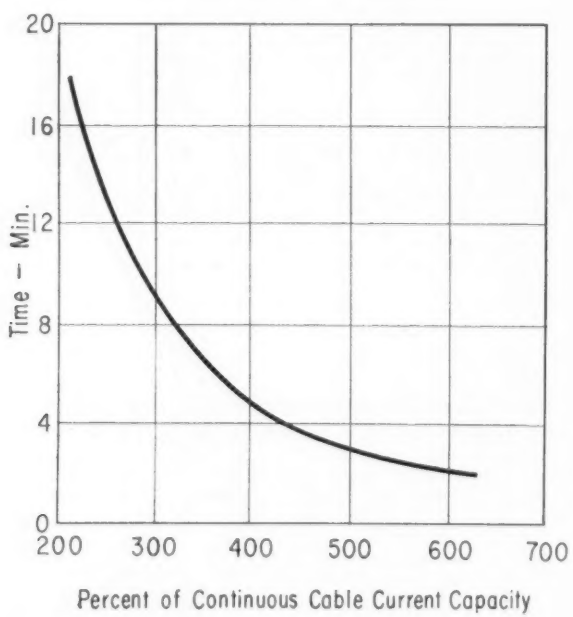


FIG 1. PERMISSIBLE TIME for short overloads on 1,000-MCM Al-polyethylene 15-kv cable sets relaying needs

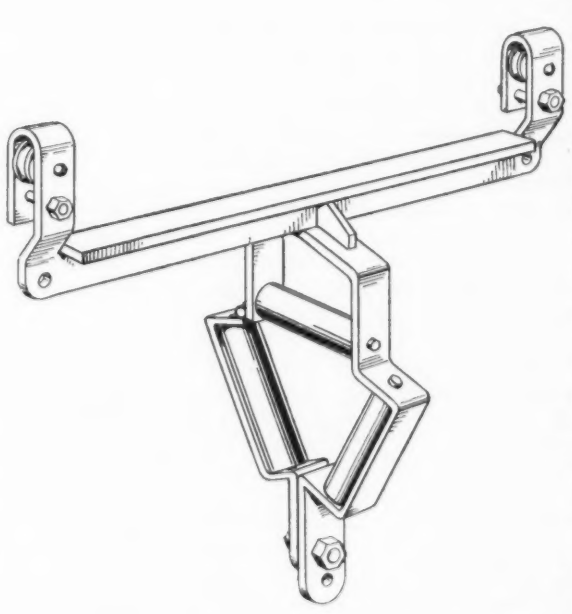


FIG 2. CABLE PLACING DOLLEY, pulled along just ahead of the spinner, trains cables in triangular arrangement

ndustrial $400,000

assure a virtual seal against contaminants and moisture. Paper-lead cable was considered but its weight, relatively long delivery time, involved splicing and terminating requirements, and higher installation costs, ruled against its use. Both butyl and polyethylene insulations met the requirements set up although both are subject to damage by corona.

The electrical characteristics of the insulations are shown in Table 1. While polyethylene has dielectric superiority, some of its characteristics require careful consideration for power cable applications:

1. Its softening point is about 105 C.
2. It has a high coefficient of expanison, which must be given careful consideration in the cable design.
3. Proper extrusion techniques must be followed to be sure that no ionizable voids exist.
4. Its flammability (although low).

Analysis of insulation characteristics narrowed the choice to polyethylene or butyl. Although these two were considered to be on an equivalent electrical basis, polyethylene was more economical.

A comparison can be drawn from Table 2. The lowest cost of butyl cables for a project were more than 1½ times as much as polyethylene cables. On this basis, savings in cable cost for the Louisiana and Texas plants exceeded $400,000.

25-C Safety Factor Included

Although the higher (85 C) temperature-rated butyl permits used smaller conductor size for a given current capacity, the larger conductor size required by polyethylene reduces I^2R operating losses. When these power losses are evaluated over the span of in-service years, polyethylene has another significant economic advantage over butyl.

In comparing costs of copper and aluminum cables, the savings in going from copper to aluminum with butyl insulation are almost entirely used up by the added insulation on the larger conductor required for equivalent conductivity. Savings of butyl-aluminum cable were, at that time, only 4% over butyl-copper cables.

On the other hand, savings of polyethylene-aluminum cables over polyethylene-copper cables were 25%. The economic advantages of the polyethylene-aluminum cables plus polyethylene's excellent electrical properties prompted the selection of this type of cable for distribution circuits.

Since polyethylene softens at about 100 to 105 C, but remains unaffected up to that temperature range, distribution designs were based on loadings that would result in maximum cable temperatures of 75 C. This allows a 25-C safety factor.

Since 90% of the cables are on radial feeders, and they are sized to carry maximum loads, they are not subjected to overloads. Where overloading is a possibility, as on tie lines, an inexpensive overload relay has been added to one of the existing current transformers of the feeder breaker. This relay either sounds an alarm or trips the breaker and prevents loading above 75 C. Permissible times at various overloads for a 1,000-MCM aluminum conductor, before the temperature reaches 95 C, are shown in Fig 1. The same arrangement has been used on tie lines having other types of cables. It was not established especially for polyethylene cables.

To avoid damage from short circuits, a curve of maximum system phase short circuit amp available against the back-up breaker, was included in cable

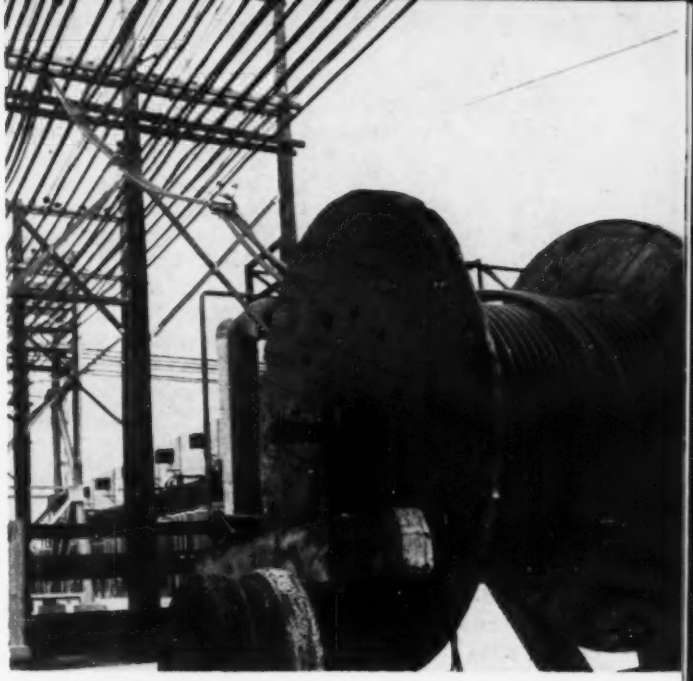


FIG 3. CABLES ARE SPUN in the field in groups of three to supporting messenger. Lengths per reel are limited to 750 ft

Table 1—Electrical Characteristics of Insulations

	Poly-ethylene	Butyl Rubber	Paper	Varnished Cambric
Dielectric Strength (a-c) vpm	500	350	550	300
Impulse Strength, vpm	1,300–1,800	900–1,200	1,700–2,000	900–1,100
Dielectric Constant 60 cps (SIC)	2.3	3.5	3.5	6.0
Power Factor, 60 cps	0.0004	0.015	0.008	0.060
Insulation Resistance (K per 1,000 ft)	50,000	20,000	10,000	5,000

Table 2—Percent Comparative Cable Costs 1957

Cable, Each Phase, 1,600 Amp	Total 3-Phase Cable Cost, $	Total 3-Phase Cable Wt, lb
1. One 1/c 2,500-MCM copper, butyl insulated	167%	38,200
2. Three 1/c 500-MCM copper, butyl insulated	160%	33,900
3. Three 1/c 650-MCM copper, polyethylene insulated	134%	28,800
4. Three 1/c 800-MCM aluminum, polyethylene insulated	100%	17,800
5. Three 1/c 700-MCM aluminum, butyl insulated	153%	22,000

Polyethylene insulated aluminum cable given as 100%. All cables are shielded, PVC jacketed.

specifications. To take care of the high expansion coefficient of polyethylene, resilient shielding construction was used in cable manufacture.

While polyethylene is flammable, it is only mildly so. When a blow torch was held to the exposed end of a cable for three to five minutes, the polyethylene burned at a slow rate with a short flame. When the torch was removed, the flame died of its own accord.

A ground fault current curve was also included as part of the cable specifications to be sure the cable shield has sufficient capacity to handle anticipated ground fault currents without destroying the shield. As a result of this specification, the manufacturers spirally wrapped cables with 24 No. 18 wires to supplement the thermal capacity of the copper shielding tape. Ground fault current is limited to 2,000 amp by the system neutral grounding resistor.

The 15-kv cables used within the past two years have been aluminum in the 700-MCM and 1,000-MCM sizes, with the latter constituting the greater quantity.

Cables are spun in the field in groups of three to a supporting messenger, Fig 3. They are ordered with the three single conductor cables paralleled on the reels. These may be operated one conductor per phase in the circuit. Or, where loads are large, the three conductors per messenger may be paralleled to form one phase of a 3-phase circuit. This arrangement increases circuit reactance and effectively limits circuit breaker short circuit duty.

Cable lengths per reel are limited to approximately 750 ft. This seems to be the optimum length that can be handled in the field and also within the conservative 3,000-lb tension considered a desirable limit in pulling cables into place.

Cable installation is relatively rapid and straightforward. In pulling cable into place, care is taken to assure equal tension on conductor and insulation, to prevent any displacement between them. Cable blocks hook over the messenger and consist of a roller divided into three spaces. These spaces prevent cables from twisting; the roller eliminates most of the friction as the cables are pulled.

Preformed Lashing Rods Now Used

Enough blocks are placed at the beginning of each span to provide support at approximately 10-ft intervals when they are spaced out. The interval is maintained by tying rings with 10-ft lengths of rope so they will follow one another train fashion as the cable is pulled. The process of feeding out supporting blocks is repeated for each span.

In the subsequent cable spinning operation, a cable placing dolly, Fig 2, is pulled along just ahead of the spinner. It trains the cables in a delta configuration, with the vertex downward, and spins the cables to the messenger in a triangular arrangement. On more recent installations, preformed lashing rods have been used to support the cable from the messenger. This appears to be a better method of installation.

Insulators are then installed in the messenger at the points where the cable sections will be spliced, Fig 4. Insulators can not be inserted earlier because exact splice locations can not be accurately determined and because the absence of insulators simplifies spinning. This keeps the messenger lengths the same as the cable lengths before splicing.

Induced Circulating Currents Prevented

Since the shields are not continuous between sections, each section of cable and its messenger between splices constitute an effective limit on induced currents. To prevent any induced circulating currents in the shields and messenger, they are tied together and grounded at one end of the section only, as shown in Fig 4.

In considering the use of aluminum conductor, special attention was given to splicing and terminating procedures. The splicing specification prepared used a connector which was specifically developed for the 1,000-MCM conductor. Its special feature is an oval section, in its uncompressed state, which becomes smoothly circular when compressed. The absence of indentation rings is expected to contribute to a more corona-free design and therefore result in a more dependable splice.

Several faults have occurred on the polyethylene-aluminum cable. All failures have been within approximately 100 ft of the cable ends (before splicing). Analysis revealed that considerable moisture had entered the cable ends prior to installation. It was then established that when the carbon impregnated cotton shielding tape used on these cables became moist, chemicals that remained in the tape from the bleaching or dyeing processes created a chemical reaction which destroyed the shielding tape. In addition, the reaction attacked the aluminum and caused considerable corrosion on the outer stranding of the conductor.

Nylon or butyl-Mylar combination is now specified for the strand shielding tape material. In addition, precautions that should have been observed originally are now being deligently observed to prevent ingress of moisture into the cable ends during manufacture, transportation, storage, and installation.

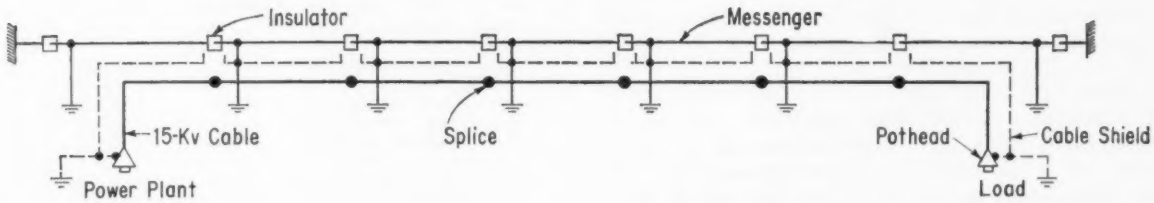
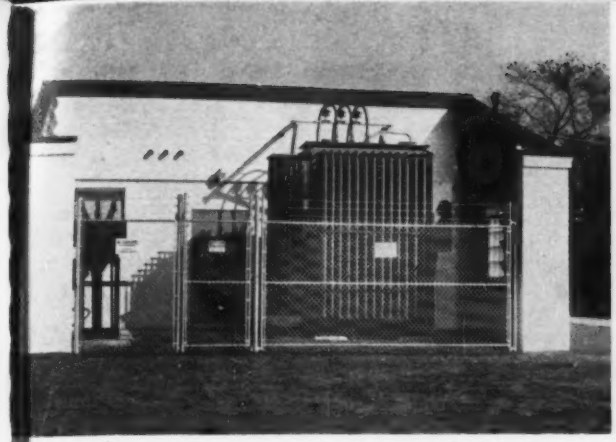
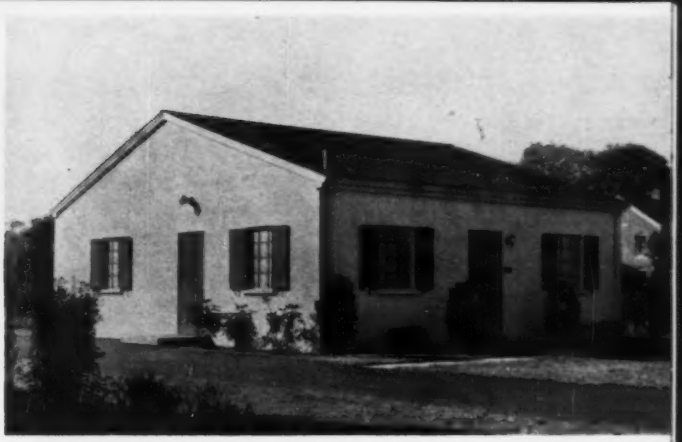


FIG 4. INSULATORS ARE INSTALLED in messenger at each cable splice. Messenger lengths are same as cable lengths. To prevent induced circulating currents in messenger and shield, they are tied together and grounded at one end



REAR OF SUB has special side walls, no roof or rear wall. Design cuts noise, simplifies front roof construction



RESEMBLING CONVENTIONAL HOUSE from front or side, distribution sub harmonizes with residential neighborhood

Residential Sub Has Novel Design

Semi-enclosed ranch type building combines aesthetics, economy. Special wall attenuates transformer hum

FLOYD W. BUCK, Superintendent of Engineering, United Illuminating Co, New Haven, Conn.

A substation design, for residential areas, that provides a very presentable appearance and low noise level without excessive investment has been developed by The United Illuminating Co. Included in the design is a unique wall construction that eliminates all except very high angle noise emanating from the transformer. The wall has been used successfully on 3,750 and 5,000-kva distribution substations.

This sound attenuating wall costs only slightly more than a conventional wall. Compared with a construction which totally encloses the transformer, it results in a very appreciable reduction in substation cost. Since the adoption of this construction, UI has had no complaints from neighbors about transformer noise, since it is impossible to hear transformer hum on either side of the building. The noise level outside the area is too low to be measured by available instruments.

Other Attenuation Methods Costly

Serving a territory which is primarily urban, UI has been building architecturally treated substations since 1940. However, to build such a substation at a reasonable cost involved a design that left the transformer in a yard partially enclosed by a building wall. This did not solve the problem of transformer noise, which in some cases proved troublesome to the neighbors. Although many techniques have been devised to reduce noise, they have always required considerable expense.

Design Simplifies Roof Construction

At the present time, UI is using a ranch type building, as shown above. The back wall of the totally enclosed part of the substation forms the support for the ridge pole. This simplifies the roof truss construction, reducing it to simple H-members. The rear half of the substation consists only of the side walls, with a small return wall at the rear to provide stability. Almost the entire back wall of the house and the back half of the roof have been entirely omitted. The transformer is installed in this open area, constituting the back half of the house and is thus open to the sky and to the rear for adequate ventilation. The back wall is closed with removable chain link fence panels. Fig 1 indicates a plan of the substation, and the location of the equipment.

Research on the sound problem of such an enclosed area indicated that if the wall is placed sufficiently close to the transformer, the escaping sound from the transformer to the near wall will be forced to go up at a large angle and will be dissipated before it can bend back to the ground.

However, the transformer noise that reflects from the wall can reach the opposite wall at such an angle that it will bend back to the ground at a neighbor's house. This is indicated in Fig 2.

The problem then is to prevent the reflection. This can be done very simply by the use of standard structural transition blocks normally used to provide transition from a 12-in. foundation wall to an 8-in. building wall. When these blocks are turned upside down and used on alternate courses with 8-in. blocks, a surprisingly effective reduction in reflection is obtained. Other configurations were tried but did not improve this simple design.

Wall Must Hide Bushings

This type of construction is used on each of the side walls enclosing the back yard. The only requirement for wall height is that it hide the bushings on the transformer. An ordinary 8-ft eave height is usually sufficient.

Because of its greater height, the rear wall of the enclosed building requires either a 12-in. wall or an involved pilaster arrangement. Moreover, to date, no neighbor has been close enough to make noise reduction directly to the rear necessary. Consequently, the attenuating design is not used on this wall.

Generally substations of this sort are supplied either by two feeders or by a feeder looped through the

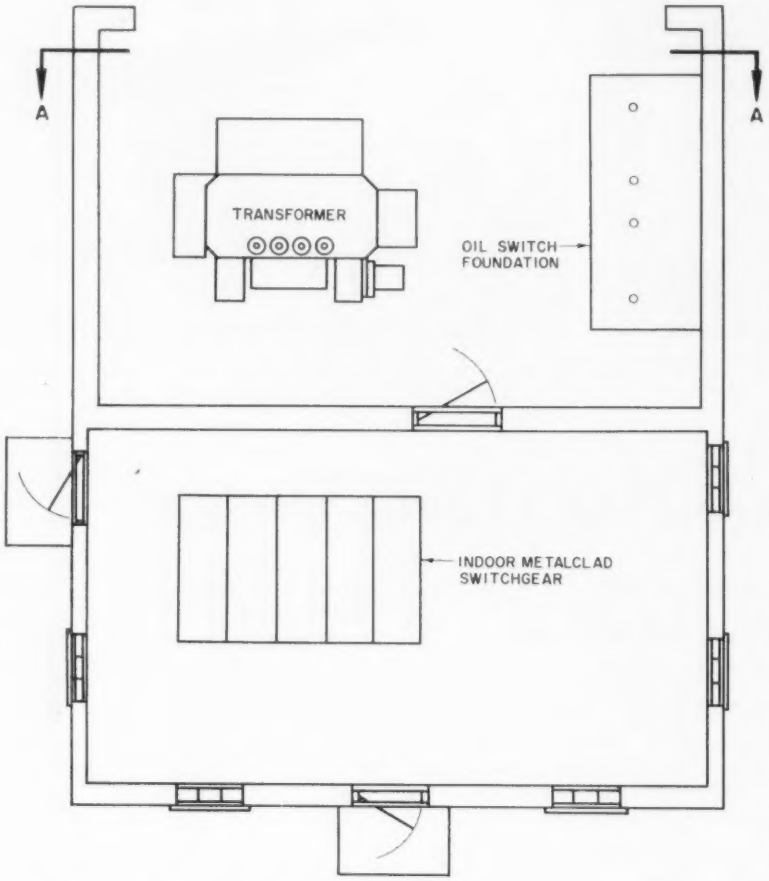


FIG 1—METAL-CLAD 4-KV DISTRIBUTION switchgear is inside enclosed portion of building. With only one transformer in substation, high voltage oil switches can be placed in rear enclosure, leaving side yard uncluttered

substation. In either case, UI's practice is to install high voltage oil switches at these stations, with connections for a mobile substation. This scheme provides complete flexibility in supply and maintenance. The 4-kv distribution switchgear is entirely inside the enclosed portion of the building.

The oil switches are installed in the walled-in backyard against the wall away from the transformers. The control handles protrude through the wall—which serves as a protective barrier for the operator—and can be operated from the building side yard. This results in a completely uncluttered side yard. A padlock on the switch handle prevents tampering or unauthorized operation.

In the past, these oil switches were installed adjacent to the building, provided with steel protective barriers for the operators, and surrounded with an 8-ft high chain link fence for protection of the neighbor's children. However, when it was decided that these substations would be provided with only one transformer, and back-up provided by a mobile substation, space became available for these switches in the yard.

By using underground conduit from standpipes on the street poles, the building appears as any other residence.

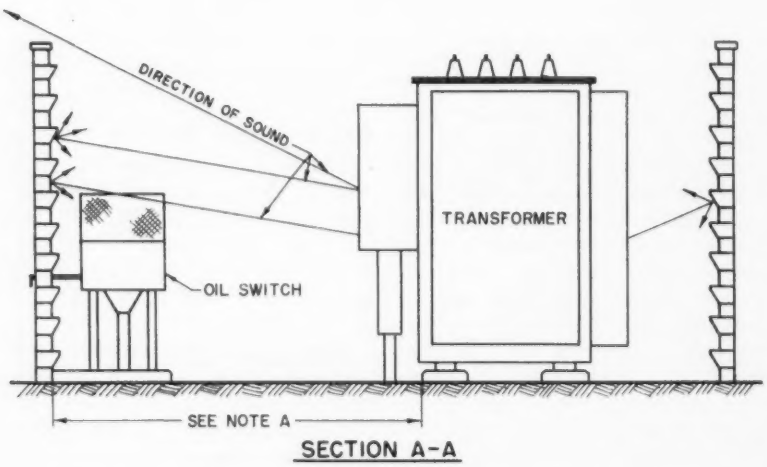
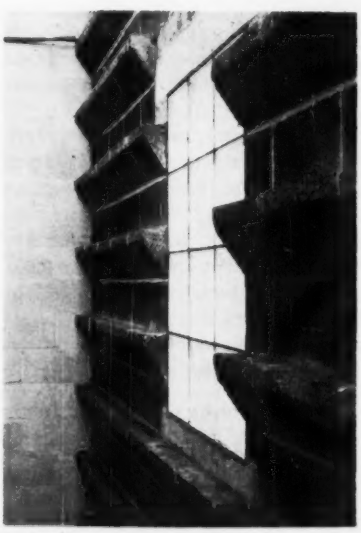
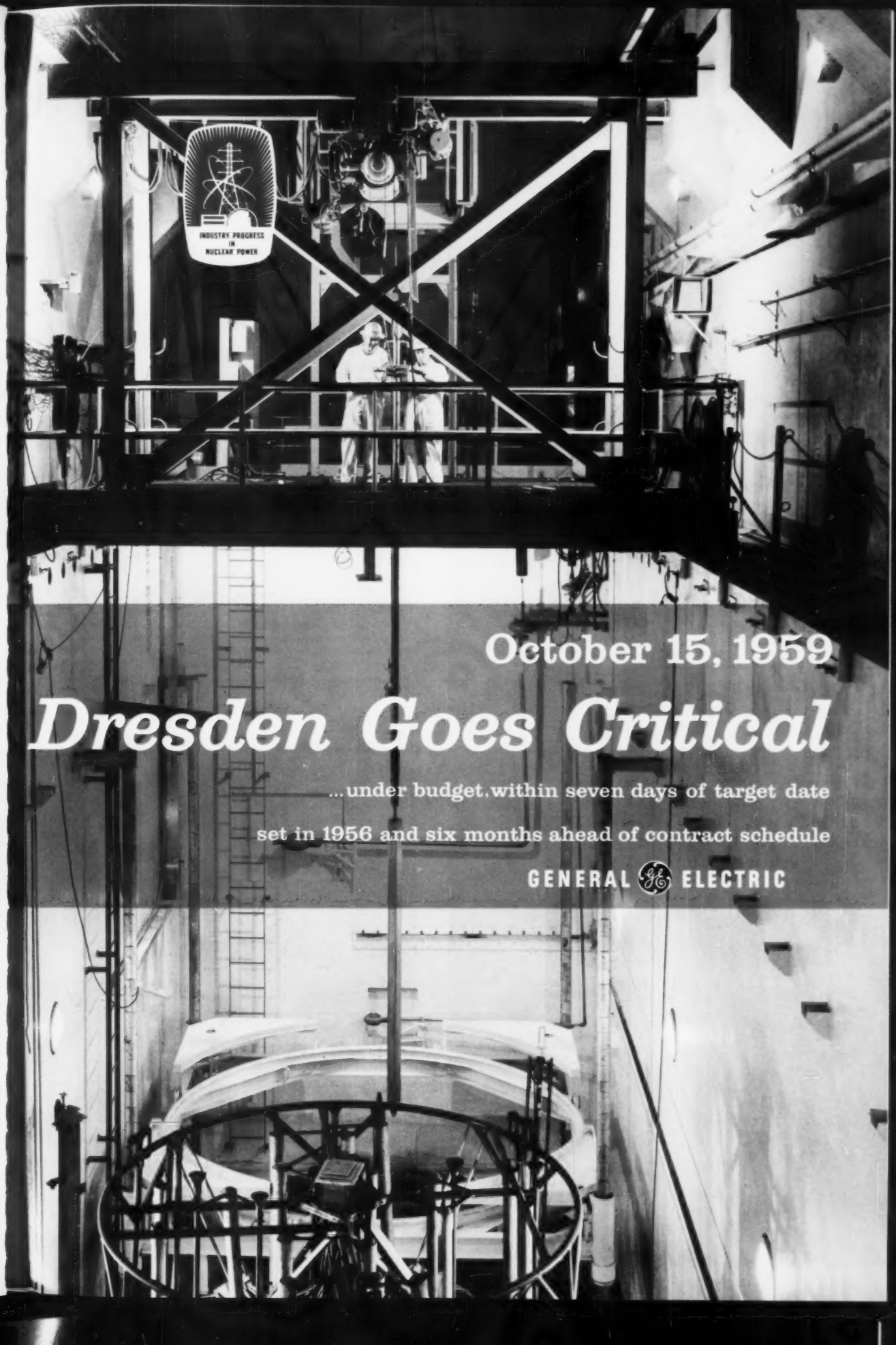

DIRECTION OF SOUND
TRANSFORMER
OIL SWITCH
SEE NOTE A
SECTION A-A
NOTE A
THIS MAY BE A CRITICAL DISTANCE. IN NO CASE HAS IT EXCEEDED 15'-6"; INDICATING THAT IT NEED NOT BE LESS THAN THAT AMOUNT.

FIG 2—SPECIAL WALL, COVERING top of bushings, kills all but very high angle noise. Oil switch handle protrudes through side wall to provide protective barrier for operator. Design includes connection for mobile substation



CORRUGATED WALL, with alternate courses of transition blocks and regular 8-in. blocks, breaks up sound



October 15, 1959

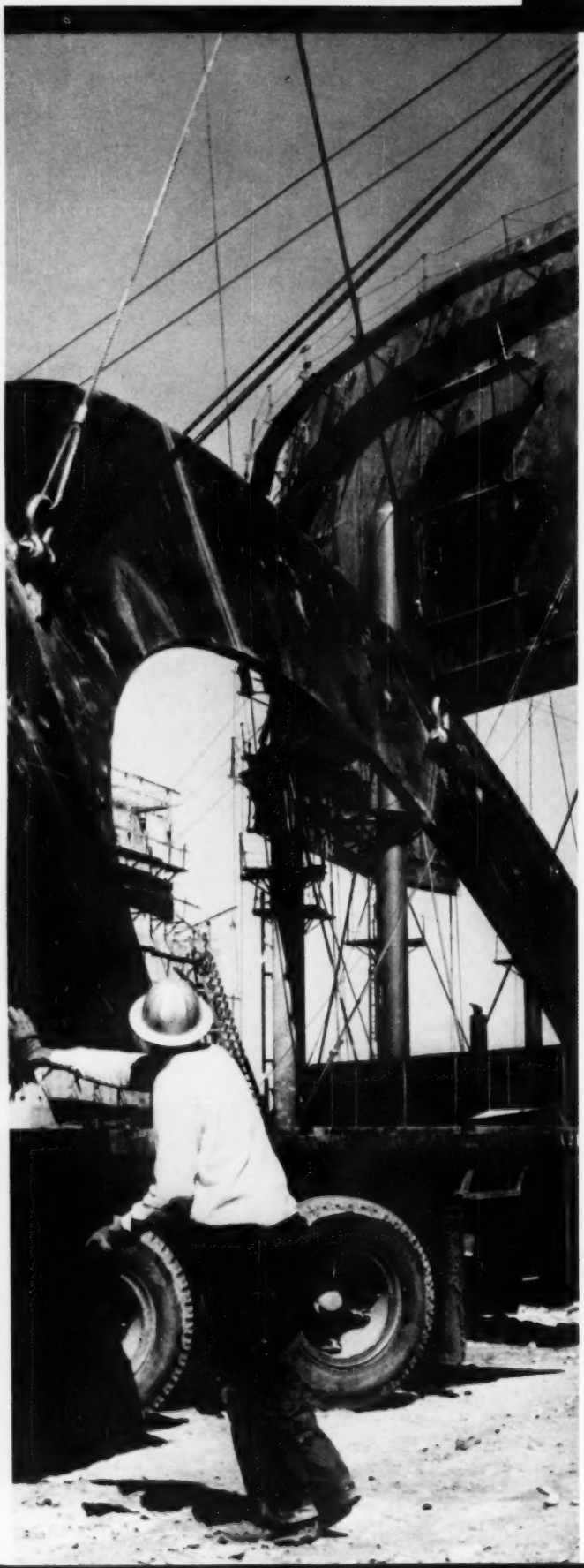
Dresden Goes Critical

...under budget, within seven days of target date

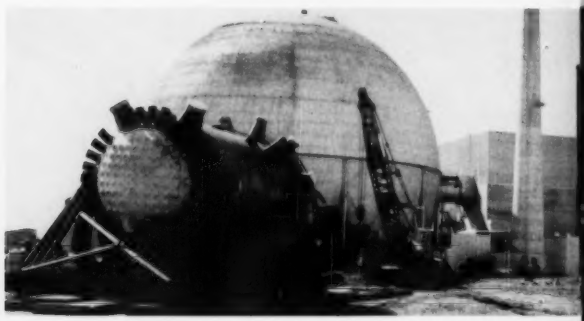
set in 1956 and six months ahead of contract schedule

GENERAL ELECTRIC

Dresden Goes Critical: evidence of advanced



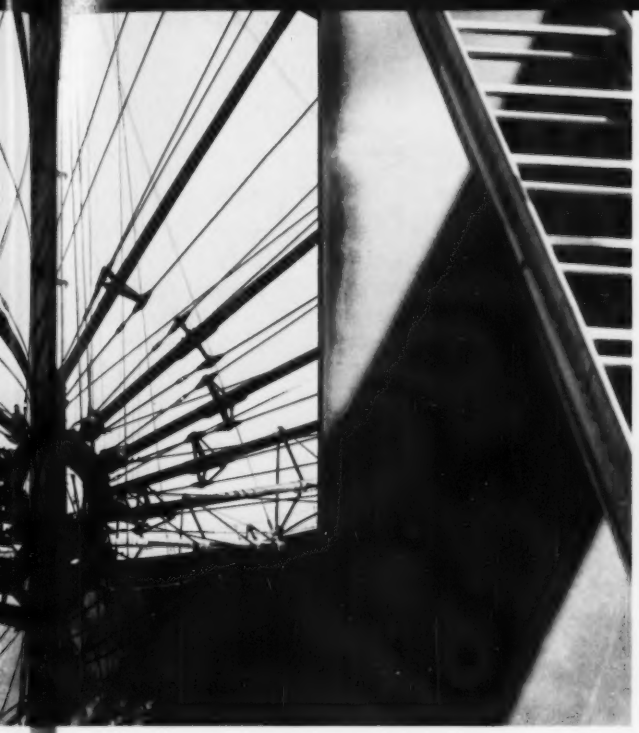
CONSTRUCTION WELL UNDERWAY—Dresden shows that advanced boiling water reactor technology permitted setting . . . and meeting . . . target construction schedule. Bechtel Corporation is the engineer-constructor.



PRESSURE VESSEL ARRIVES—Dresden utilizes a dual-cycle reactor. Experience gained with Dresden has extended boiling water reactor technology beyond other types.

DRESDEN COMPLETE—Privately financed, Dresden Nuclear Power Station is the nation's first full-scale, all-nuclear power station, will supply 180 mw (e) to the Chicago area in 1960.

d boiling water reactor technology



CONTAINMENT SPHERE NEARS COMPLETION—Dresden shows capital costs for boiling water reactors can be predicted accurately, the complete nuclear plant built at a fixed price.

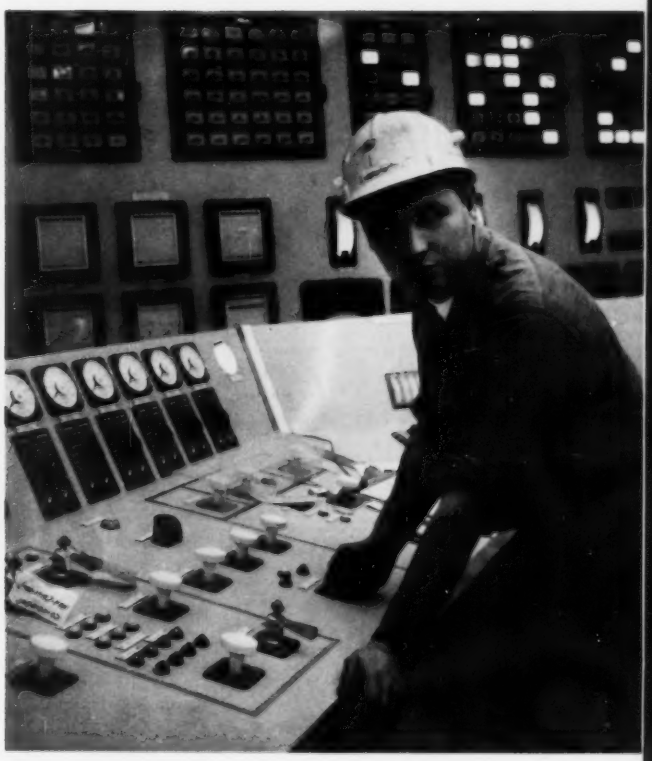
Commonwealth Edison's Dresden station—the nation's first full-scale, all-nuclear power station—reached criticality at 2:45 AM on October 15 after the 28th fuel element was inserted into the reactor core.

As illustrated on these pages—at Dresden, General Electric demonstrated its capability to design and build a complete nuclear power plant at a fixed price. Construction goals set in 1956 were bettered by six months and costs held within original estimates.

The Dresden Nuclear Power Station is evidence of advanced boiling water reactor state-of-the-art, its capacity to bring economical nuclear power fastest, and at least cost . . . through the practical step-by-step program shown on the next page.

GENERAL ELECTRIC

UEL READIED—Dresden experience helps establish technology and duce costs for mass-produced oxide fuels. Completely loaded Dresden e will hold 488 elements like these shown in fuel storage room.



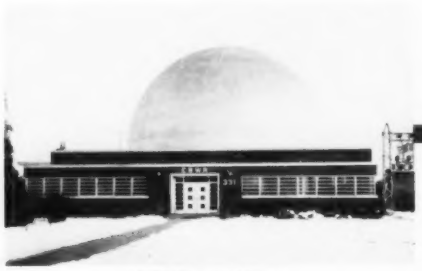
DRESDEN CRITICAL—Operating tests begin immediately after criticality at Dresden to obtain core data, calibrate reactor instrumentation, progress through gradual steps to full-power operation.

Nation's utilities continue to support the technological advances required to achieve economical nuclear power

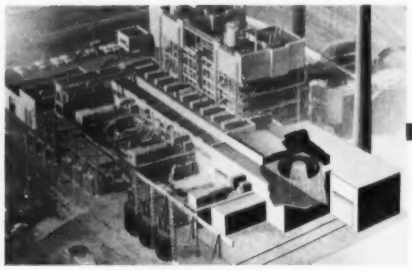
The Dresden Nuclear Power Station was built for Commonwealth Edison Company of Chicago and the Nuclear Power Group, Inc.*, and will supply power to the Chicago area in 1960. Privately financed, it is another dramatic example of how America's electric utilities—in cooperation with manufacturers and constructors—are advancing technology to keep electricity today's greatest bargain.

More and more emphasis is being placed on development of the full potential of the boiling water reactor for fastest realization of economical nuclear power, at minimum cost and least technological and financial risk. Completion of the Technical Development Program shown below will achieve that goal.

FOR MORE INFORMATION on participation in this industry program to achieve economical nuclear power, contact your nearest General Electric Apparatus Sales Office or write to: Section 192-23, General Electric Co., Schenectady 5, N. Y.



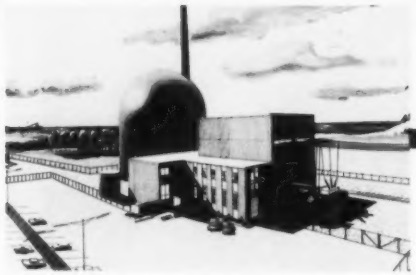
EBWR-1953–57



HUMBOLDT BAY
Pacific Gas & Electric Co.

COMPACT-1
Compact-1 is needed to develop optimum design and construction simplicity for forced-circulation plants.

VBWR-1957
Pacific Gas & Electric Co.



BIG ROCK POINT (Proposed)
Consumers Power Co.

DRESDEN-1960
Commonwealth Edison Co.

SEPARATE SUPERHEATER-1
Separate Superheater-1 is needed to evaluate operation and maintenance characteristics, extend nuclear superheat technology.

*American Electric Power Service Corp., Bechtel Corp., Commonwealth Edison Co., Central Illinois Light Co., Illinois Power Co., Kansas City Power & Light Co., Pacific Gas & Electric Co., Union Electric Co. of Missouri.

Progress Is Our Most Important Product

GENERAL ELECTRIC

first cost of better house insulation and of supplementary heat storage; and for following good practices in sizing house heating systems and operating them (except those with supplementary heat storage) under fixed settings of indoor thermometers."

". . . All around us are indications that the public wants electric house heating at reasonable prices; house builders are considering the use of electric house heating because frequently they can save on cost of the house; propaganda on the advantages of electric house heating is rising. Certain utilities as public servants will have to supply electricity required for this application. If they cannot do it economically for their stockholders, and for all of their customers, they will suffer the consequences in earning rates, which could lead to financial difficulties."

"Many utilities whose system peaks occur in the summer are already seeking the house heating load from short-range considerations, as complementary to the house-cooling load. But the benefits result only for relatively small saturations. From long-range considerations it is becoming clear that now is the time for the industry to guide the development of the house heating load, to make economic sense in the future. It is dangerous to let it drift under prevailing product concepts, customers' operating practices, load characteristics and rate forms . . ."

Report of Load Research Committee

B. P. DAHLSTROM, General Manager, Rates and Market Research Public Service Electric and Gas Co

"The load characteristics of the large-use customer have been relatively unimportant in the past because of the small number of such customers in the residential class. However, as the saturation of large energy-using devices increases, the large-use customer is becoming more numerous with a much larger load than ever before. As a result, load characteristics of the large-use customer now have more weight in determining the load shape of the residential class than they have had in the past. . .

"The load factor of the large-use customers, having similar saturations of large appliances, tends steadily upward with increased annual use, based on noncoincident maximum demands per customer. . . Since the *diversified* load factor of residential customers remains comparatively constant over a wide range of use, the load characteristics of these large-use customers can be said to be more desirable than those of the average customer in the residential class, and points out the advantages of sales promotion in the residential field. . . This statement does not mean, categorically, that increasing the kwhr use per customer will automatically result in an increased annual load factor. Different saturations of various appliances can result in different residential load characteristics; some tend to improve the load factor and others can reduce load factor. From the (Pittsburgh) data we see that on a noncoincident basis the annual load factor varies from 8.1 to 26.8%. On a diversified basis, there is a narrower range from 41.4 to 54.5%.

"The Commercial and Industrial Loads Subcommittee (also) reported studies. . . For groups of customers having demands in the range of 5 to 10 kw in both summer and winter periods, loads are quite uniform throughout the day and do not show the characteristic lighting use peak (in winter evening hours) of small-size (less than 5 kw) customers.

"The load curves for groups of customers having demands in the range from 40 to 100 kw begin to show the industrial characteristics with a sharp drop off during the noontime period. . .

"On most systems, the majority of customers in the commercial-industrial category have demands less than 10 kw. Therefore, as in the case of residential load, there is a broad area in the commercial-industrial field where increasing kwhr use improves the individual (noncoincident) customer load factor with no apparent deterioration in the diversified load factor. . ."

"The Specific Loads Subcommittee has reported studies of the load characteristics of residential customers with electric air conditioning installations—heating and/or cooling. . .

"The diversified load factor of all-electric homes using heat pumps was 25.6% in Detroit, 25% and 23.8% for the two tests in Washington, and 23% in the Southern California area. These results confirm last year's report that, on the basis of data then available, the load factor of all electric homes with either heat pumps or resistance heating was found to be approximately 25%. . ."

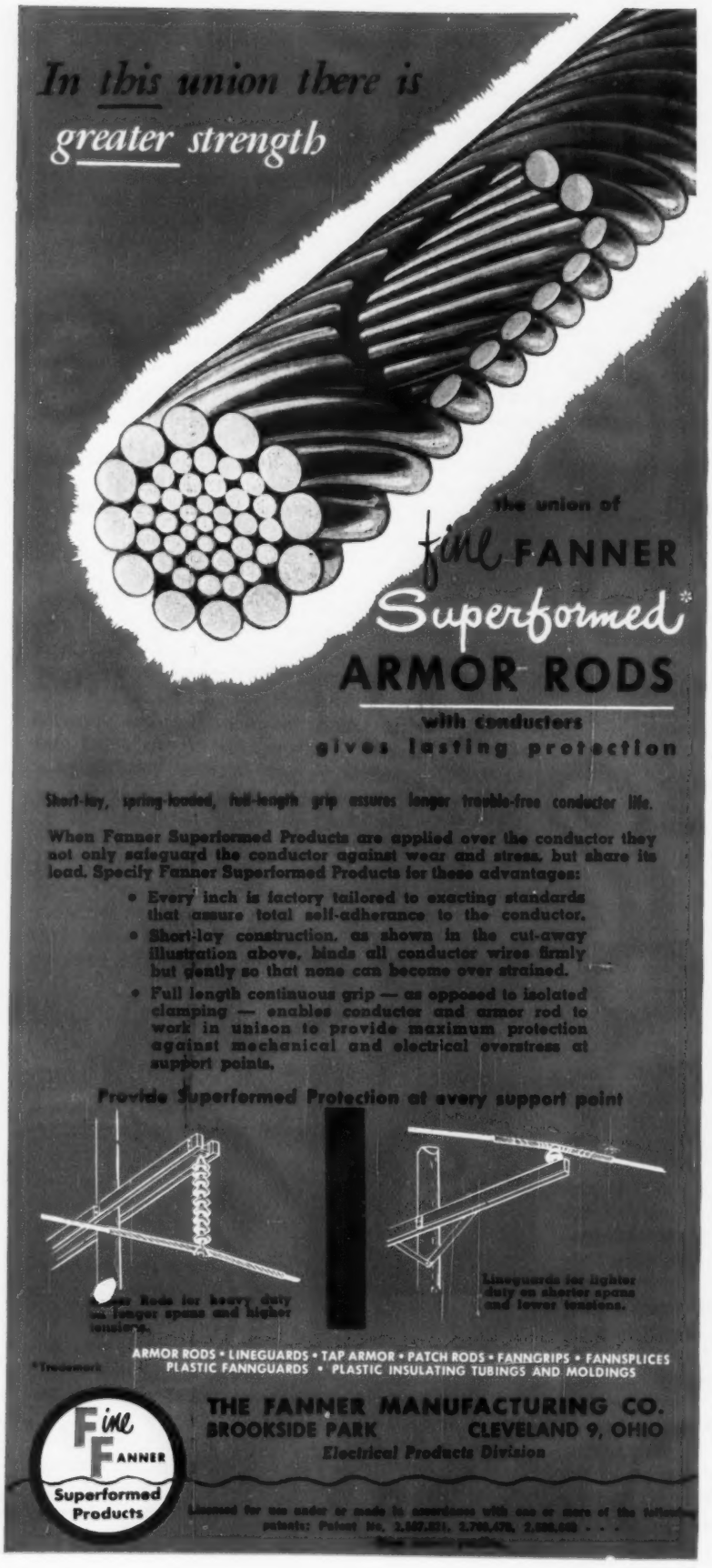
Report of Committee on Appliances and Servicing

E. O. GEORGE, Vice President, The Detroit Edison Co

"Utilities are showing greater interest in the appliance servicing problem . . . Surveys show that almost all utilities have not only recognized the problem but faced it and are doing something about it . . .

"We find that the manufacturers are making progress. There is new awareness of service on their part. They are beginning to 'design with service in mind'. The appliance service demonstration workshops (sponsored

(*Continued on page* 60)


In this union there is greater strength
the union of
fine FANNER
Superformed*
ARMOR RODS
with conductors
gives lasting protection
Short-lay, spring-loaded, full-length grip assures longer trouble-free conductor life.
When Fanner Superformed Products are applied over the conductor they not only safeguard the conductor against wear and stress, but share its load. Specify Fanner Superformed Products for these advantages:
• Every inch is factory tailored to exacting standards that assure total self-adherance to the conductor.
• Short-lay construction, as shown in the cut-away illustration above, binds all conductor wires firmly but gently so that none can become over strained.
• Full length continuous grip — as opposed to isolated clamping — enables conductor and armor rod to work in unison to provide maximum protection against mechanical and electrical overstress at support points.
Provide Superformed Protection at every support point
Linegaurds for lighter duty on shorter spans and lower tensions.
*Trademark
ARMOR RODS • LINEGUARDS • TAP ARMOR • PATCH RODS • FANNGRIPS • FANNSPLICES
PLASTIC FANNGUARDS • PLASTIC INSULATING TUBINGS AND MOLDINGS
THE FANNER MANUFACTURING CO.
BROOKSIDE PARK CLEVELAND 9, OHIO
Electrical Products Division
Fine Fanner Superformed Products

AEIC Meeting

(*Continued from page* 59)

by AEIC) have played an important part in this improvement.

"In order for this initial success to continue, the Committee recommends:

- Workshops be continued as a watchdog for the industry.
- Public schools be encouraged to establish adult training programs for appliance servicing.
- Establishment of customer relations training programs for servicemen and servicing contractors by utilities.
- A program for educating the consumer in the need for occasional service and the need for the servicing agency to charge a reasonable fee if he is to provide good service.
- A program to build prestige for the servicing contractor.

Report of Committee On Switching and Switchgear

H. R. KURTH, Vice President, Boston Edison Co

"The increasing density of generating plants and transmission systems has resulted in very high rates of rise of recovery voltage which imposes very severe duty on the interrupting capability of circuit breakers.

"A working group of your committee has completed a series of tests and studies on several systems and is presently engaged in computing and analyzing these results to arrive at the actual values of voltage recovery and steepness of wave fronts which must be recognized in the circuit breaker design. Indicated values of 10,000 volts per microsecond or higher, already encountered, are far in excess of those experienced in European utility systems, except England where the highly concentrated grid around London shows wave fronts nearly as steep. It is expected that the initial results of this study will become available in 1960.

"Many applications of circuit breakers require automatic high speed reclosing to restore service after a momentary fault, and existing standards impose a considerable reduction from normal interrupting rating for such service. A task force

(*Continued on page* 64)

ANOTHER STEP AHEAD IN VOLTAGE REGULATION

POSITIVE NEUTRAL INDICATION

NEW

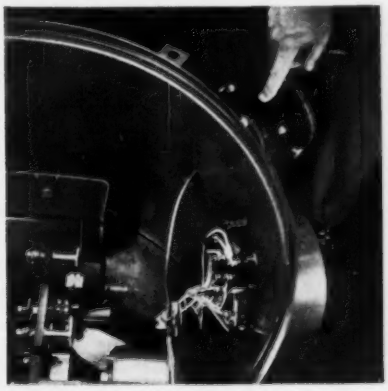
Mark-II position indicator for G-E voltage regulators protects lineman and equipment

Exclusive Mark-II Load Bonus position indicator and indicator drive system for General Electric single-phase step voltage regulators provide positive indication of tap-switch position. This gives more assurance against fear of injury to personnel or equipment when bypassing regulators on hot lines.

Linemen are aware that if a regulator is bypassed with the tap-switch off neutral position, the dead short created across part of the series winding can destroy equipment and seriously endanger the lineman.

It is important that operating personnel *know* that regulators are in the neutral position before bypassing. The new General Electric Mark-II Load Bonus position indicator provides this assurance.

New Mark-II position indicator system—standard on all G-E ML-32 regulators at no price premium—is an example of General Electric's continuing leadership in voltage regulators. This is another reason why G-E regulators cost less on the line. Ask your regulator representative for more information. General Electric Company, Schenectady 5, New York. 423-43



NEW MARK-II INDICATOR drive system eliminates possibility of indication error. Unique locking coupling and gear-driven indicator assure positive alignment of indicator hand and tap-switch position.

Progress Is Our Most Important Product

GENERAL ELECTRIC

THOMAS JEFFERSON BUILDING

Electrical services are fed from two 4,000 amp. main distribution boards. Each of the main switch boards is fed by 8-500 MCM conductors per phase.

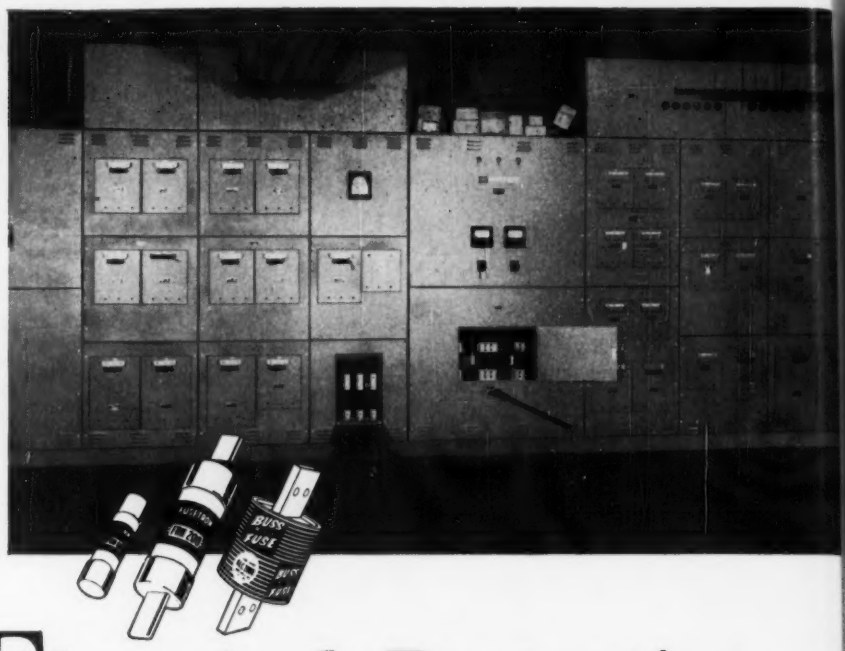
Switch Board #1

Protected by: 3-4000 amp. BUSS Hi-Cap Fuses . . . 12-600 amp., 30-400 amp., 3-200 amp. FUSETRON Fuses.

Switch Board #2

Protected by: 3-4000 amp. BUSS Hi-Cap Fuses . . . 6-600 amp., 33-400 amp., 39-200 amp. FUSETRON Fuses.

All distribution panels protected by FUSETRON dual-element fuses.



Electrical Protection goes MODERN *with* BUSS Fuses

in St. Louis' Newest Multi-Storied Office Building . . .

The Thomas Jefferson Building is another outstanding example of BUSS Hi-Cap and FUSETRON dual-element fuses meeting the requirements for a modern protective device for use in modern electrical systems.

Today's electrical networks, with their tremendous capacities, have emphasized the need for a superior protective device that can be relied on to safely and dependably handle faults of great magnitude.

BUSS Hi-Cap and FUSETRON fuses, because of their high interrupting capacity and life-time dependability have become the natural choice in both new installations and when electrical systems are being modernized.

WHY HIGH-INTERRUPTING CAPACITY AND DEPENDABILITY ARE ESSENTIAL FOR A MODERN PROTECTIVE DEVICE...

CAPACITY

The magnitude of fault current is only limited by the capacity of the transformers or networks. These capacities have been increasing yearly — and most likely will continue to increase.

A modern protective device, therefore, must be capable of interrupting faults of 75,000 to 150,000 ampere which are available today — and be adequately safe to allow for future system growth.

BUSS Hi-Cap and FUSETRON dual-element fuses meet this requirement. The interrupting rating of BUSS Hi-Cap fuses is 200,000 rms symmetrical — and for FUSETRON fuses it is 100,000 rms symmetrical.

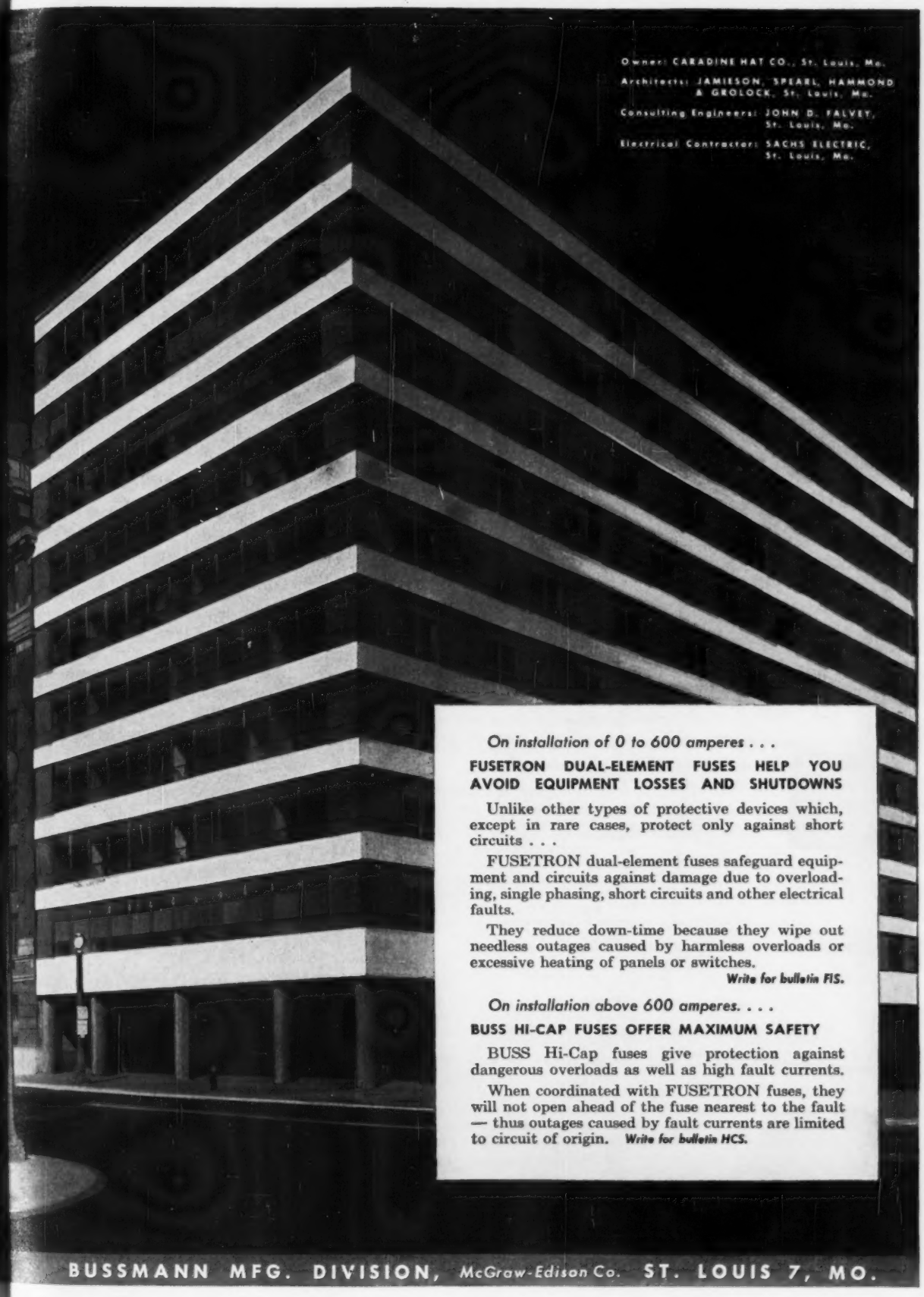
LIFE-TIME DEPENDABILITY

The *Modern* protective device should remain just as safe and accurate through the years as it is on the day installed. Otherwise, how can you be sure it will interrupt these high fault currents should trouble occur 10, 15 or 20 years from now.

This requirement too, is met by BUSS Hi-Cap and FUSETRON fuses — They remain safe and accurate and require no periodic inspection or recalibration, as they have no hinges, pivots, latches or contacts to stick or get out of order.

129

ANOTHER BUSS HI-CAP AND FUSETRON FUSE INSTALLATION


Owner: CARADINE HAT CO., St. Louis, Mo.
Architects: JAMIESON, SPEARL, HAMMOND & GROLOCK, St. Louis, Mo.
Consulting Engineers: JOHN D. FALVEY, St. Louis, Mo.
Electrical Contractor: SACHS ELECTRIC, St. Louis, Mo.

On installation of 0 to 600 amperes . . .

FUSETRON DUAL-ELEMENT FUSES HELP YOU AVOID EQUIPMENT LOSSES AND SHUTDOWNS

Unlike other types of protective devices which, except in rare cases, protect only against short circuits . . .

FUSETRON dual-element fuses safeguard equipment and circuits against damage due to overloading, single phasing, short circuits and other electrical faults.

They reduce down-time because they wipe out needless outages caused by harmless overloads or excessive heating of panels or switches.

Write for bulletin FIS.

On installation above 600 amperes. . . .

BUSS HI-CAP FUSES OFFER MAXIMUM SAFETY

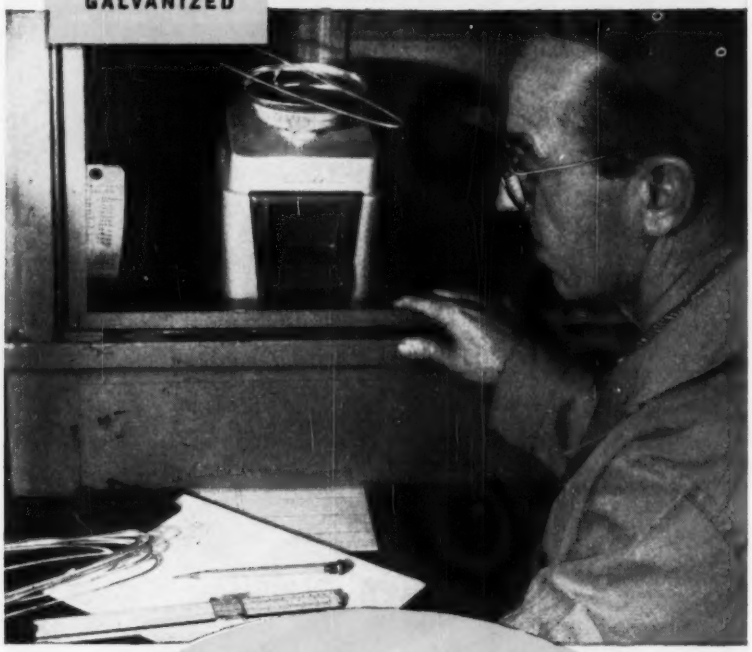
BUSS Hi-Cap fuses give protection against dangerous overloads as well as high fault currents.

When coordinated with FUSETRON fuses, they will not open ahead of the fuse nearest to the fault — thus outages caused by fault currents are limited to circuit of origin. ***Write for bulletin HCS.***

BUSSMANN MFG. DIVISION, *McGraw-Edison Co.* **ST. LOUIS 7, MO.**

Crapo GALVANIZED

STEEL STRAND



WEIGHT OF COATING TEST

...added assurance of dependability

The life of galvanized steel strand depends primarily upon the weight and quality of the zinc coating. The heavier the coating the longer the strand will last.

The wire used in CRAPO Galvanized Steel Strand is regularly subjected to the hydrochloric acid antimony chloride, or weight of coating, test. By means of this test the amount of zinc on the surface of the wire can be accurately measured.

This is but one of the many laboratory tests to assure consistently high, dependable quality in the finished product.

AVAILABLE IN 3 COATING WEIGHTS

CRAPO Steel Strand is regularly furnished in all standard sizes and grades and in Class A, B and C coatings. Class B coating is twice as heavy as Class A coating; Class C coating is three times as heavy.

Write for this FREE BOOKLET!

"The Story Behind CRAPO Galvanized Wire and Strand" describes and illustrates manufacturing and testing techniques. Ask for Booklet B-59!

INDIANA STEEL & WIRE CO., INC.
Muncie, Indiana

AEIC Meeting

(*Continued from page* 60)

of this committee has reached virtual agreement with the manufacturers on minimizing the reduction in rating for reclosing service. European practice in this regard does not recognize any reduction in rating."

". . . A wider knowledge of foreign practices and a greater influence upon international standards is needed by the American investor-owned utilities. On a few occasions, some of our member companies have sent representatives to the annual meetings of the International Electrotechnical Comm. or the CIGRE conventions, but regular attendance is needed to represent the American user viewpoint. . . ."

Report of Committee on Power Generation

G. R. MILNE, Chief Mechanical Engineer, Consolidated Edison Co of New York

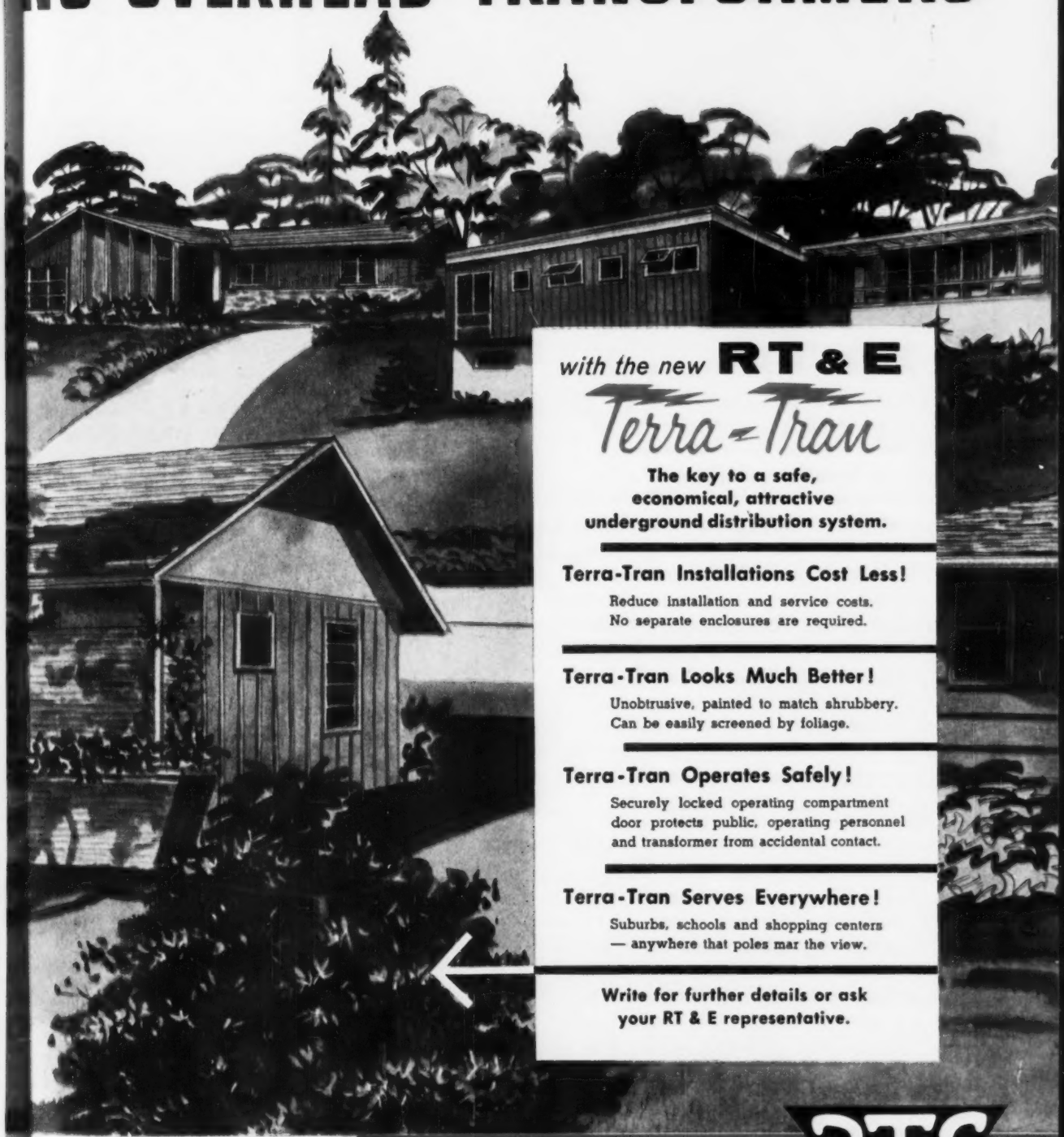
"Orders for generating equipment for the electric utility industry reach a peak at intervals of approximately five years, while during each interval the annual capacity ordered is only a fraction of the peak.

"The present cycle shows the same trend. The capacity of turbine-generator orders for 1958-1959 aggregates only 3,169 Mw as compared to 17,414 Mw ordered in the year 1955-1956. Since the end of the current report year on April 30, 1959, orders placed to September 1, total 2,347. If the rate is continued for the rest of the report year it will total 7,041 Mw, thus showing the usual cyclic trend. A more representative long-term trend of purchases may be had by plotting the five-year averages. This shows a continuing rise in purchases from 900 Mw in 1946 to 10,400 Mw at the end of the 1959 report year."

". . . The current year was notable for the purchase by TVA of a second 3,850,000 lb. of steam per hour boiler to be used with the 500-Mw Parsons turbine to be installed at their Colbert plant. This Babcock & Wilcox boiler will be the universal-pressure type with steam conditions at the superheater outlet of 2,575 psi and 1,053 F, and a reheat temperature of 1,003 F. Including this purchase by TVA it is

(*Continued on page* 66)

NO POLES NO EXPOSED LINES NO OVERHEAD TRANSFORMERS



with the new **RT & E**

Terra-Tran

The key to a safe, economical, attractive underground distribution system.

Terra-Tran Installations Cost Less!

Reduce installation and service costs. No separate enclosures are required.

Terra-Tran Looks Much Better!

Unobtrusive, painted to match shrubbery. Can be easily screened by foliage.

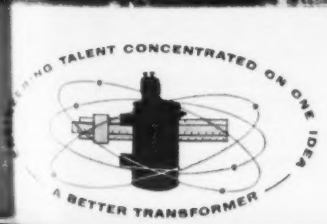
Terra-Tran Operates Safely!

Securely locked operating compartment door protects public, operating personnel and transformer from accidental contact.

Terra-Tran Serves Everywhere!

Suburbs, schools and shopping centers — anywhere that poles mar the view.

Write for further details or ask your RT & E representative.



RT&E CORPORATION

WAUKESHA, WISCONSIN • PORTLAND, OREGON

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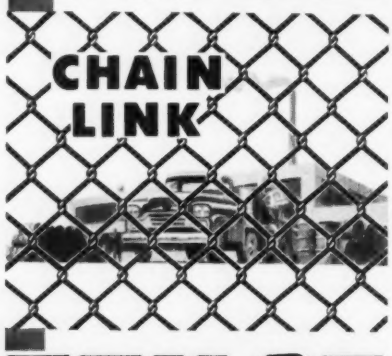


FENCE

Fence value depends on
—quality materials
—quality installation
You get both from PAGE

New Aluminized Fabric!
(other quality fabrics available:
galvanized steel,
aluminum,
stainless steel)

8 basic fence designs
6 gate styles

Expert installation
by specialists

Registered Certificate
of Quality furnished
to property owner

Good fences—since 1883

Write for helpful booklet

PAGE FENCE ASSOCIATION
National Headquarters • Monessen, Pa.

A product of Page Steel & Wire Division
American Chain & Cable Company, Inc.

AEIC Meeting (*Continued from page 64*)

significant to note that Federal and Municipal purchases during the current report year represent 25% of the total . . ."

"During the report year the most significant development in the gas-turbine industry has been the extensive study and consideration of the use of gas turbines for economical peak load applications and one large utility has purchased two 20,000 kw units for such application.

". . . There are a total of 31 (nuclear) power projects in various stages ranging from operation to announcement of plans. Of these a total of eight power projects are in operation of which only one, the 60,000 kw unit at Shippingport is of commercial capacity. The remainder are in the range of developmental or pilot stage units. . . . Plans have been announced for five additional units. The largest of these is the 50,000 kw boiling water reactor for the Consumers Power Co."

Report of Committee on Power Distribution

H. P. WHITEHEAD, Vice President, Georgia Power Co

"The Extra High Voltage Cable Field Testing Program continues to occupy first place in Committee activities. . . . Cable manufacturers have been vigorously active in design and manufacturing techniques and have promised test samples during the period September 1959 to April 1960."

". . . The first four or five months of the testing program scheduled to start in January 1960, will be consumed in preliminary testing at low voltages to gain facility in operation of the station, and in making the measurements. The regular testing schedule would begin in June 1960, and will continue for an estimated period of three years.

". . . Another vital area where product and design improvements have been adding greatly to the art of distribution is tower design and innovation. Cleveland reports that existing 138-kv line and anchor towers are currently being raised to additional heights of 10, 20 and 30 ft for installation of larger conductors. . . . Philadelphia reports the use of all-aluminum towers on a three-mile double circuit 220-kv line which will traverse an area where several industries combine to produce a highly-contaminated atmosphere. Commonwealth Edison reports purchase of aluminum alloy towers for a six-mile 46-kv line."

"The application of digital computers to the solution of engineering and operating problems continues to increase. A system computer application section has been set up by American Electric Power Co. . . . Consumers Power reports half their transmission and distribution planning work now is done on the digital computer. Detroit Edison reports that one of their programs determines costs of various secondary distribution designs.

". . . A cooperative investigation by Public Service and Westinghouse of the basic principles of system planning has been undertaken to answer . . . 'What is the optimum plan to follow in expanding system generation and transmission to meet increasing loads?' . . . The program is approximately 60% complete."

Report of Meter and Service Committee

A. W. RAUTH, General Meter and Laboratory Superintendent, Consumers Power Co.

"With all the new developments in electronics, the question has been raised as to whether or not it would now be economical to set up a device to contact the customer's meter. A device on the meter would then send impulses over a telephone circuit to the power company central billing department and cause an IBM billing card to be punched. This card would be placed in billing machine which would automatically print a bill with the consumer's address on the card. The Meter Committee has a representative on a national committee that is currently studying the practicability of such an automatic meter reading device . . ."

"Centralized automatic testing of watthour meters, is becoming more favorable because large numbers of meters are of the socket type and are set outside; therefore, they can be more easily removed and reset

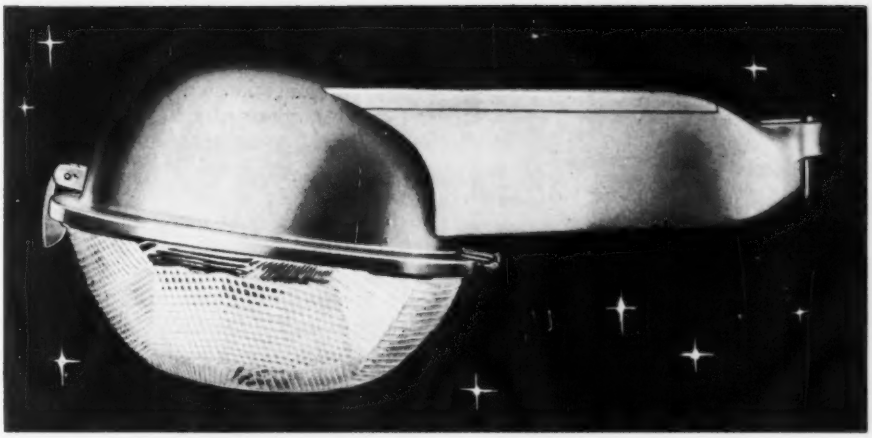
(*Continued on page 68*)

STYLE 69 Pemco 400 watt Mercury Luminaire with built-in ballast —

Constant wattage — 100-130/200-260 V.
Constant wattage — 200-260/400-520 V.
Reactor type — 240 V.

Available with NEMA standard twist lock adapter for photoelectric control. For 2" end mounting, or 1¼" mounting by using spacer clamp.

Request Bulletin 124 for specifications and construction details.



PEMCO

NEW ADVANCED DESIGN

400 WATT MERCURY LUMINAIRES

with Pemco-Holophane Refractor

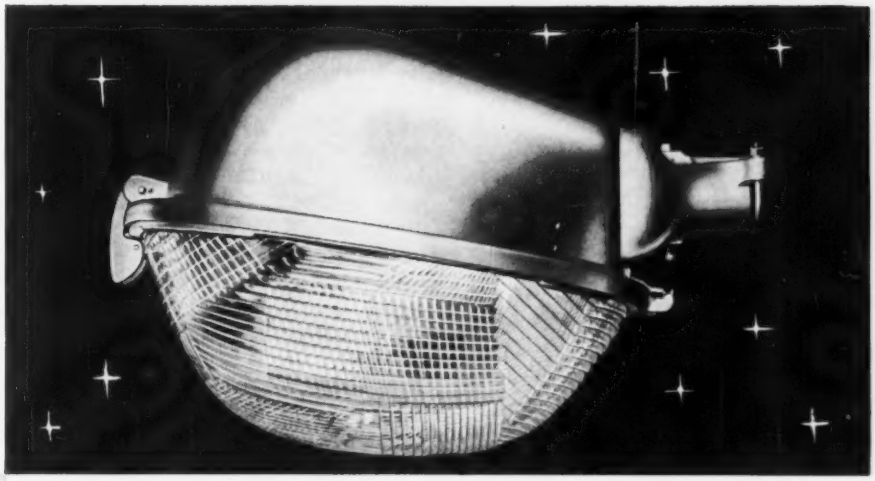
IES Types II, III & IV

STYLE 68 Pemco 400 watt Mercury Luminaire.

Available with NEMA standard twist lock adapter for photoelectric control. For 1¼" or 2" end mounting.

Performance curves on this and Style 69 on application.

Request Bulletin 122 for specifications and construction details.



Pemco

PEMCO LIGHTING HAS BEEN QUALITY LIGHTING SINCE 1882

PHILADELPHIA ELECTRICAL & MANUFACTURING COMPANY

1200-36 N. 31st Street • Philadelphia 21, Pa. • P. O. Box 8359

CUT INSTALLATION and SERVICE COSTS on rural entrances...

Hi-LINER

pole-top metering
and circuit breaker cabinets

- *one complete package— 200 amp. service and more!*
- *no meter-loop needed!*
- *heavy duty industrial-type circuit breakers— ground level disconnect!*

Cut installation and service costs on entrances of 200 amps. or more—eliminate costly, power consuming meter-loops with HI-LINER! Head and shoulders above the usual pole-top metering installation, the Hi-Liner combines an overhead mounted current transformer with ground controlled line switches in rain-tight steel cabinet. Installation is fast . . . all you need is one 4-conductor #12 cable and ½" conduit running down the pole to the meter. No more heavy wire loop, weatherhead, large diameter conduit —and you'll eliminate the entire voltage drop of the meter loop! Now your customer can disconnect his entire system for emergencies or repairs—and you'll eliminate countless service calls on disconnects and local failures.

NEW! Two-way split entrance breaker—provides all the advantages of the Hi-Liner plus a split of the 200 amp service into two 100 amp. lines. Breakers may be ground controlled either individually or simultaneously.

NEW! Underground secondary—contains a 200 amp. meter socket, 200 amp. circuit breakers with overcurrent protection, secondary wiring trough and terminal strip in one compact, pre-wired package!

WRITE TODAY—for detailed specifications on single phase, three phase, split-breaker, and other Hi-Liner units.

NOTE: Choice distributor territories available, write to:

HI PRODUCTS, INC.
7722 WENTWORTH SO. MPLS. MINN.
A subsidiary of GENERAL ELECTRONIC CONTROL, INC.

AEIC Meeting (*Continued from page 66*)

than the bottom connected type . . .

"Two such schemes are now in operation in a number of places. In one system the meter is placed in the machine manually and then tested automatically at three standard loads: full, inductive, and light. Once the meter is started on the test cycle, less than a minute is required to complete the test. Accuracies appear on an electronic counter that automatically prints the accuracy on a card. . .

"Another system consists of two conveyors in parallel. The operator is located between the conveyors . . . loads the conveyor with meters to be tested and then presses a button. Meters automatically come into position three at a time, and are automatically tested at heavy load, light load, and inductive load. Accuracies are indicated on three standard meters . . ."

Report of the Policy Committee on Water Requirements

L. W. CADWALLADER, Vice President and Mechanical Engineer, Potomac Electric Power Co

"In 1980 the generating capacity requirements will be approximately four times today's total installed capacity. The cooling water requirements in 1980, and the amount of heat to be dissipated will represent astromical figures beyond the comprehension of the average citizen . . ."

". . . In order to supplement natural fresh water supplies, much attention and research is being devoted to the conversion of sea water into fresh water. Freeport, Texas was recently selected as the site for a U. S. Government sponsored distillation plant which is expected to produce fresh water at a cost of approximately $1.00 per 1,000 gal.

"The problems of thermal pollution is becoming increasingly active across the country. State water pollution control boards are giving particular attention to this aspect of the overall pollution problem. . . .

"Temperature of the condenser cooling water is of great importance and there is an increasing trend toward the demand to reduced temperatures entering surface water streams. . . . If a solution to this trend is not forthcoming by an intelligent approach, there may result the enactment of pernicious laws and regulations, with major impact on the power industry . . ."

"In a land where fresh water supplies once appeared inexhaustible, most authorities now agree that long range planning is absolutely essential in order to insure adequate water resources in the future. . . ."

Report of Committee on Air Pollution Policy

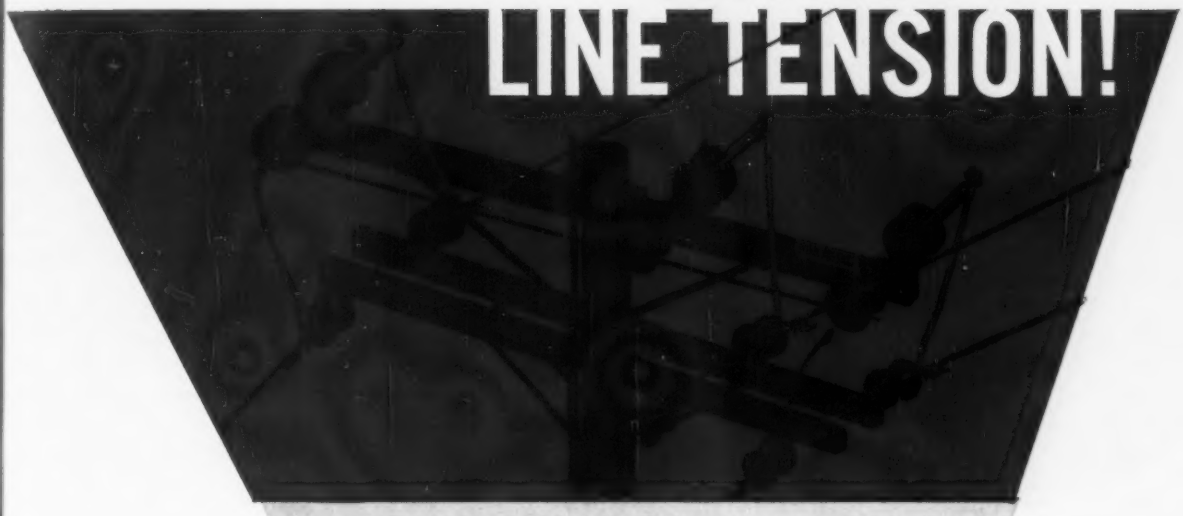
G. V. WILLIAMSON, Vice President, Union Electric Co

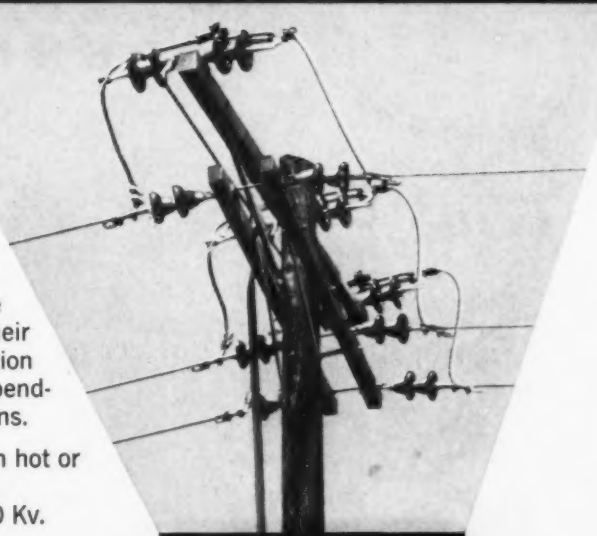
"During the past year public interest in air pollution has continued undiminished and the problem remains a major one in some communities, particularly on the west coast."

". . . Your association, along with EEI and the coal industry, has contributed in the past year to two research projects being conducted by the Bituminous Coal Research, Inc. The sulfur dioxide project is now in its second year of a two-year program and includes work on a gas-phase oxidation process. Research and development on the reduction of sulfur in coal *prior* to use is also being conducted . . . Collection and characterization of coals for investigation have been completed and initial results have been obtained in the liberation of pyrite from the coal substance by selective pulverization. Progress achieved to date shows considerable promise."

"The intensive work in collaboration with Babcock & Wilcox Co for the reduction of nitrogen-oxide formation in boiler furnaces has been continued. One full-sized boiler is now operating at El Segundo (So. Cal. Edison) with two-stage combustion developed as a result of earlier testing. Reduction of nitrogen-oxide formation by 40% to 50% is indicated. New boilers are being bought for use of two-stage combustion. The Los Angeles Air Pollution Control District has suggested the need for an additional rule to regulate nitrogen oxides in combustion gases. . . ."

INSTALL KPF SWITCHES WITH OR WITHOUT LINE TENSION!





KPF air break switches operate equally well with or without conductor tension—tension is not necessary to their smooth functioning. Thus KPF switches may be installed on angle poles, major crossings or other locations where separate deadends are desired. Further, their simple design eliminates lubrication or maintenance, and insures dependability under all weather conditions.

KPF switches may be installed on hot or dead lines, and are available for common voltages from 7.5 to 110 Kv.

Test KPF switches with an installation on your own system. Inquire now!

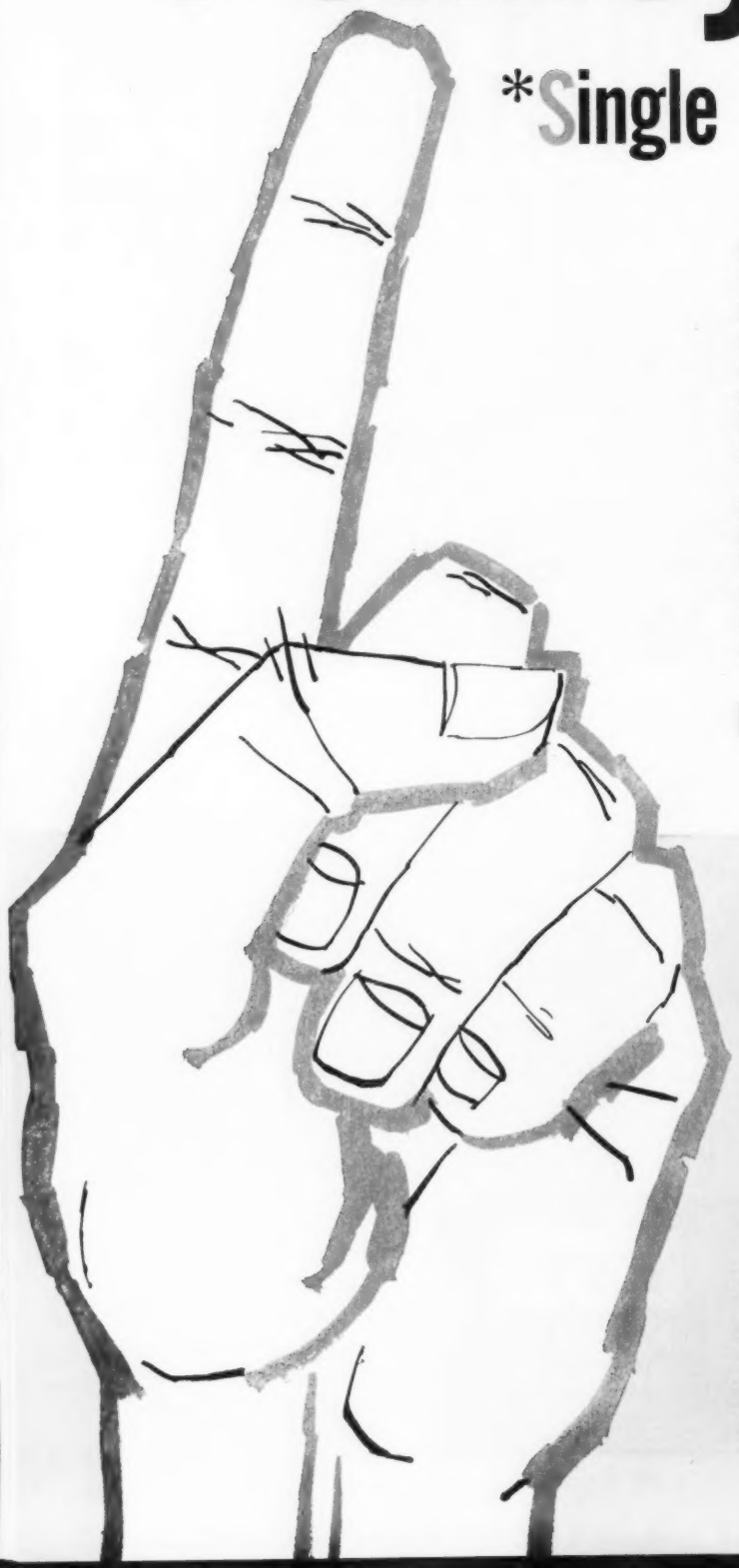
KPF ELECTRIC COMPANY

KPF
AIR BREAK SWITCHES
Standard for half a century

P.O. Box 1257E
Stockton, California
HOward 4-8381

Pennsylvania

*Single Source of Supply



Single- and Three-Phase Ratings

With the recent introduction of its single-phase Pole Star Regulators, Pennsylvania Transformer can now provide utilities with a complete line of voltage regulating equipment—from the smallest single-phase pole-type regulator, to three-phase load tap changing and regulating transformers as large as 250,000 kva.

Included is a Pennsylvania innovation that has captured the attention of the entire electrical industry: the Phase-Isolated LTC transformer. This new product—a three-phase transformer that provides individual voltage regulation of each phase—offers a sound solution to many substation application problems.

PENNSYLVANIA

Pole Star Regulator for Platform or Pad Mounting

Pole Star Regulator for Pole Mounting

SINGLE-PHASE POLE STAR REGULATORS

Available in 27 single-phase distribution ratings for pole-top, platform and station installations. The Pole Star Regulator combines Pennsylvania Transformer's highly successful experience in two related fields: distribution transformers and power-transformer load tap changers.

SSOS*

for all load tap changing equipment

Regulation in 32 Steps of 5/8%

Pennsylvania LTC equipment usually provides plus or minus 10% regulation in 32 steps of 5/8% each, although variations can be made to suit individual requirements. The various mechanisms used are based on design principles that have been proved in hundreds of installations over a period of many years.

Service-Simulated Test Runs

All production of LTC mechanisms is subject to strict quality control—with C.A.A.D. (the Control Apparatus Assembly Department) having complete responsibility for every step from the manufacture and testing of components through the final assembly of mechanisms on regulators and load tap changing transformers.

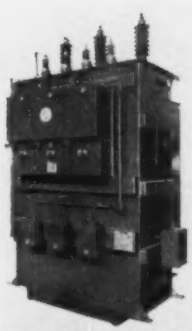
To further assure that the high standards long associated with the name Pennsylvania Transformer are maintained, each LTC mechanism undergoes service-simulated test runs—as many as 5000 tap changes for larger units.

Write for Descriptive Bulletin

Pictured on these pages are representative examples of Pennsylvania Transformer voltage regulating equipment. For details of the load tap changing mechanisms used with these products, write on your company letterhead for Bulletin 81. Pennsylvania Transformer Division, McGraw-Edison Company, Canonsburg, Pennsylvania.

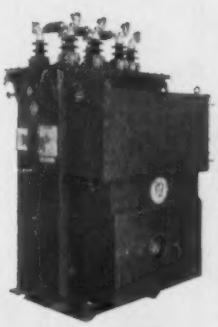
McGRAW-EDISON

TRANSFORMERS AND REGULATORS

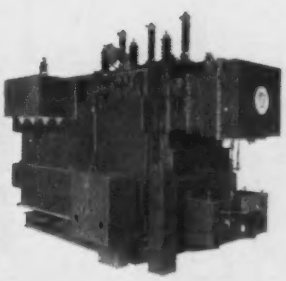


PHASE-ISOLATED LTC TRANSFORMERS (patent pending)

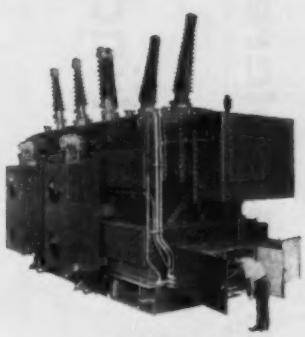
A three-phase LTC transformer that offers all the advantages and flexibility of single-phase regulation. Each phase has an individually controlled LTC mechanism, plus a bypass and grounding switch. The unit pictured is 3750/4687 kva.



225-kva Step Voltage Regulator



50,000-kva LTC Transformer



150,000-kva LTC Autotransformer

THREE-PHASE STEP VOLTAGE REGULATORS, LTC TRANSFORMERS, LTC AUTOTRANSFORMERS AND REGULATING TRANSFORMERS

The complete three-phase line includes step voltage regulators from 120 through 2500 kva, load tap changing transformers from 750 through 250,000 kva, and load tap changing autotransformers and regulating transformers from 10,001 through 250,000 kva.

Find Fuel Costs Quickly

L. E. MESSMORE, Engineer, Monongahela Power Co, Fairmont, W. Va.

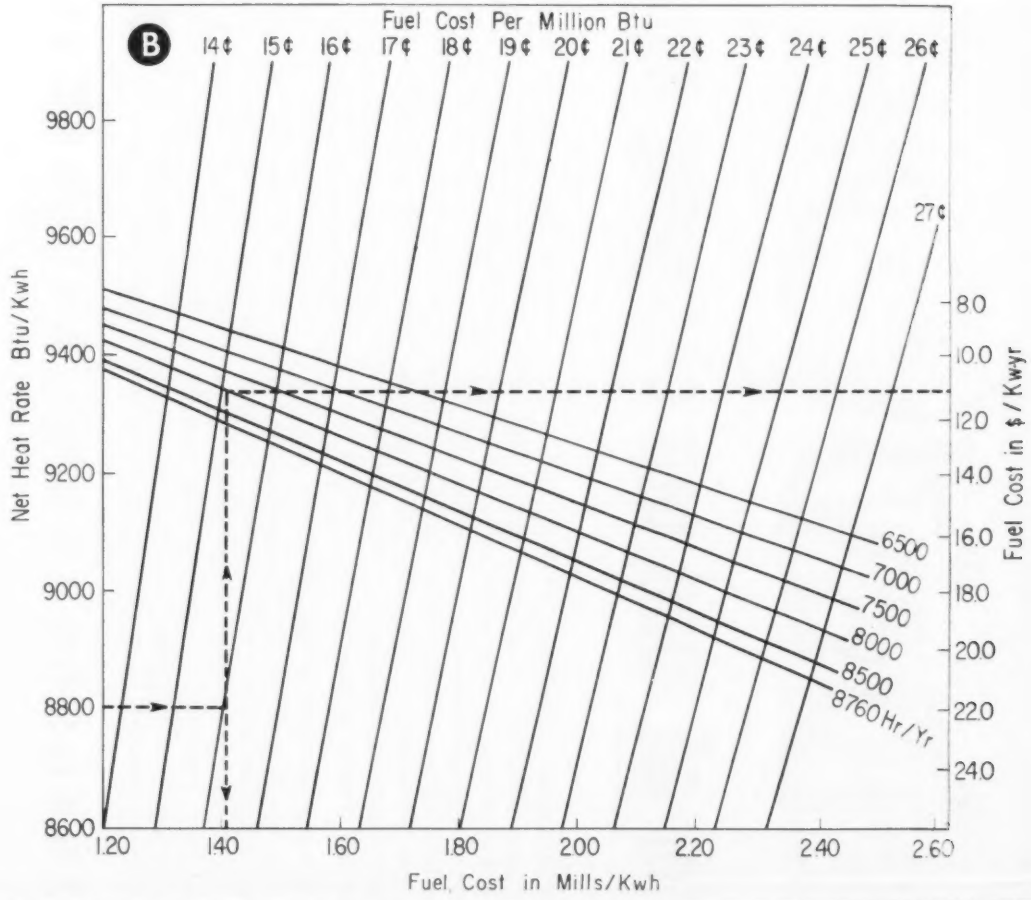
Fuel costs may be found in units of:
1. dollars per kilowatt-year
2. mills per kilowatt-hour (or dollars per megawatt-hour)
3. millions of dollars per year
4. dollars per year per BTU per kilowatt-hour

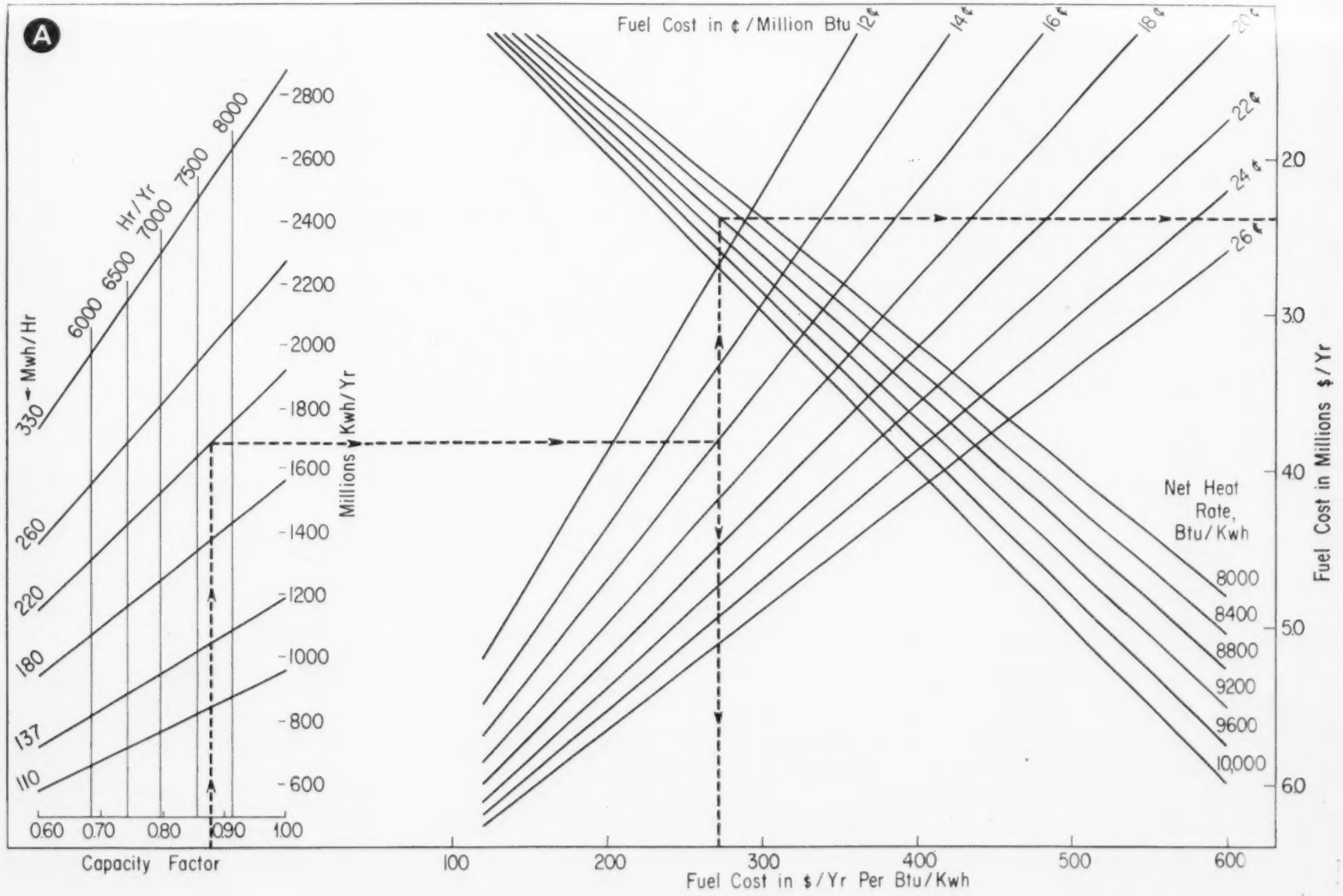
These costs are given for:
1. different sized units (or annual output)
2. different capacity factors (or hours per year operated)
3. different fuel costs
4. different heat rates

The example outlined follows the dashed arrows.

(A) 0.88 capacity factor × 8,760 hr/yr × 220 Mwh/hr = 1.696 millions kwh/yr
1.696 × 16¢/million BTU = 271$/yr per BTU/kwh
271 × 8,800 BTU/kwh = 2.385 millions $/yr

(B) 8,800 BTU/kwh × 16¢/million BTU = 1,408 mills/kwh
1.408 × 8,000 hr/yr = 11.264 $/kw-yr




A
Fuel Cost in ¢/Million Btu
12¢
14¢
16¢
18¢
20¢
22¢
24¢
26¢
Hr/Yr
6000
6500
7000
7500
8000
330 ← Mwh/Hr
260
220
180
137
110
Millions Kwh/Yr
2800
2600
2400
2200
2000
1800
1600
1400
1200
1000
800
600
Net Heat Rate, Btu/Kwh
8000
8400
8800
9200
9600
10,000
Fuel Cost in Millions $/Yr
2.0
3.0
4.0
5.0
6.0
0.60
0.70
0.80
0.90
1.00
Capacity Factor
100
200
300
400
500
600
Fuel Cost in $/Yr Per Btu/Kwh

Shop Spare Improves Breaker Overhaul

H. H. MARSH, General Supt of Substations & Shops, Duquesne Light Co, Pittsburgh, Pa.

Use of spare, replacement units cuts outage time and assures better control over workmanship in the overhaul of draw-out type, air-magnetic breakers. Replacement breakers known as "shop spares" are installed in place of units scheduled for overhaul, which units after overhaul then become the shop spares.

This practice of breaker overhaul covers about 160 air-magnetic units of various makes and types installed in the last 19 years in attended, unattended and unit substations. All of these breakers operate at 4,160 v and for the most part protect radial circuits or lines without duplicate feed.

Overhaul of breakers in service requires that the circuit be supplied from other sources, such as a tie-in with a feeder already carrying its own load or a portable substation. Use of such temporary sources involves connecting and disconnecting time and expense, charges for hauling, and the need to do the work during light-load periods.

Breaker inspection, to be done properly, necessitates considerable dissassembly for inspection of hard-to-reach parts. This is especially so in the case of the solenoid-operating mechanism which is on the bottom of the breaker and whose parts are quite critical of adjustment. Furthermore, the location of the breaker is such that inspection is affected by adverse weather, such as rain, snow or low temperature. Thus, actual field inspection which might require extensive dismantling has been found to be impractical.

To facilitate inspections under these conditions

without lengthy outage, it has been found most practical to replace the entire breaker with a shop spare of the same type. During a very short outage or tie-over of the circuit, the spare is interchanged with the breaker being removed from service. The removed breaker is taken to the shop for overhaul, which can be made under controlled conditions independent of outside weather and where the best possible job of overhaul can be made.

This method of overhaul is used except in a few instances when the number of a particular type of breaker does not justify the purchase of a shop spare. These breakers usually are overhauled in the field with the circuit carried by an "auxiliary bus" or other separate source.

Patrol Vehicle Masters Swamp or Snow

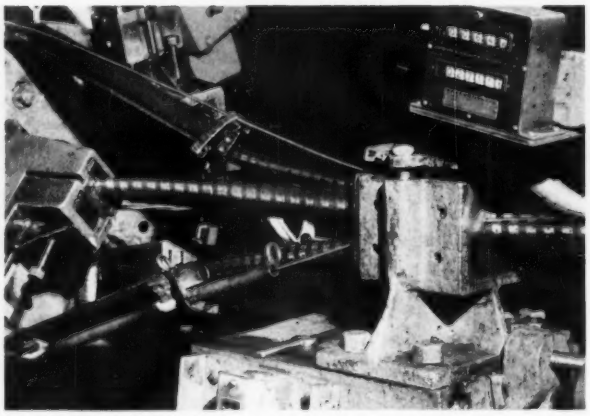
Swampland or snow-covered ground poses no problem for a patrol vehicle put into service by Long Island Lighting Co. The "weasel" type of vehicle also travels over land at 26 mph and makes up to 3 knots on water. The unit is particularly valuable for patrolling electric lines in most emergency situations.

The vehicle, a 2-ton surplus amphibian, seats three, is 10 ft long, and is powered by a six-cylinder automobile engine. It has two adjustable outrigger pontoons (converted aircraft wing fuel tanks) for added buoyancy in water. It mounts an hydraulically operated plow and an electric winch.

WHAT'S THE DIFFERENCE IN ELECTRICAL WIRE AND CABLE?

You'll find the difference in

Research and development. American Steel & Wire maintains a large staff of fully qualified engineers whose objective is to improve existing products and develop new ones. This is the key to a successful research program.



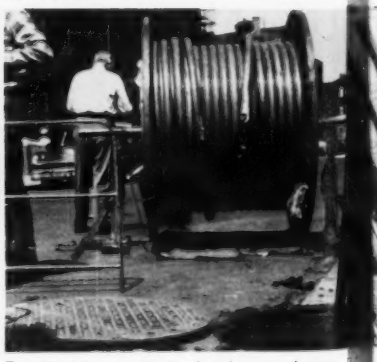
Design Engineering. Cable design is an art in itself requiring ability to combine electrical and mechanical elements to withstand all the destructive forces encountered in service.

Quality Control. From conductor to jacket, every step of manufacture is carefully controlled to make sure you receive the best Tiger Brand Cable for your particular application.

Specially engineered USS Tiger Brand Electrical Cables

For mining machines. Amerclad cables that provide long service in spite of bending, twisting and general hard usage.

For shovels. Cables that operate continuously under the most adverse conditions of weather and abrasion.



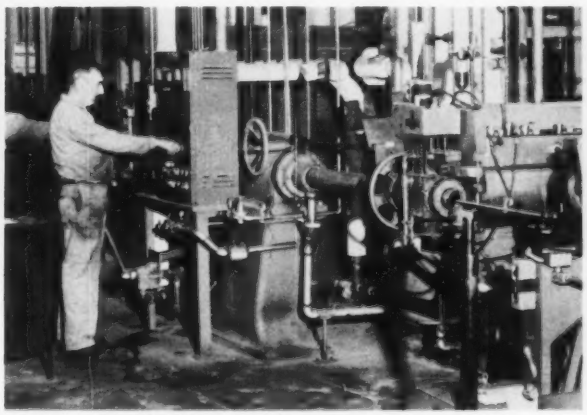
For city power systems. Lead-covered, gas-filled, paper cables for reliable service.

USS Tiger Brand—here's why!

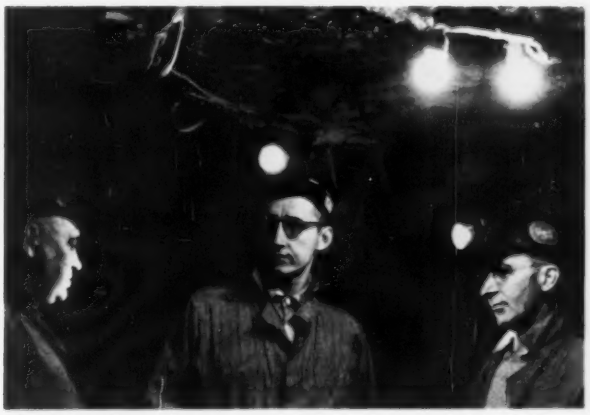
For more than 68 years, American Steel & Wire has been producing the finest quality electrical wire and cable. In this period, we have constantly aimed to improve materials, develop better constructions and use the best cable manufacturing processes. We have two good reasons for doing this; first, our customers demand the most reliable cable they can get, and second, they want the advantages of the latest developments in research, design and engineering.

The differences in electrical cable are seldom visible at a glance. They show up, for example, in mining machine cable that absorbs shock and vibration, withstands crushing weights, and severe abrasion for unbelievably long periods. Or they appear in a new irradiated polyethylene cable designed for extra-high resistance to heat and moisture . . . in submarine cables that work under water for 30 or 40 years . . . in power cables that resist corona cutting.

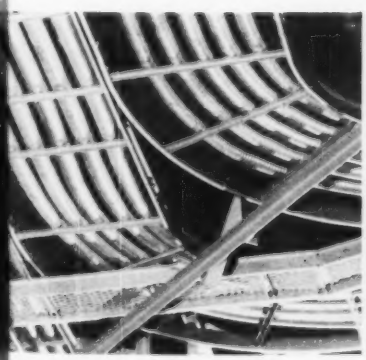
In USS Tiger Brand Cables, you reap the advantages of all the research, engineering skill and manufacturing experience gained in making every type of cable from the smallest control cable to the largest dredge cable. There is a difference in cable—and you'll find it by using Tiger Brand.



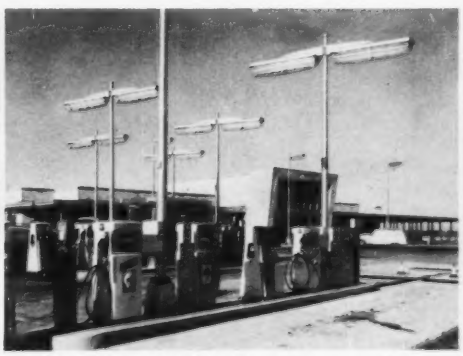
Modern Production Equipment. This new and up-to-date continuous vulcanizer is just one of the many new pieces of precision equipment that result in uniform high quality of USS Tiger Brand Electrical Cables.



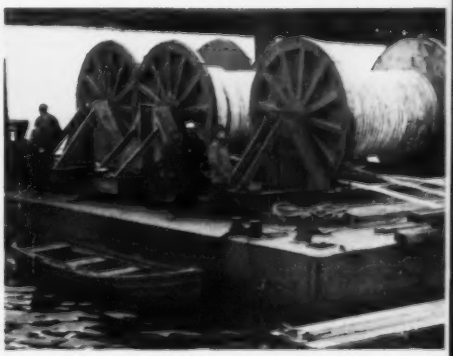
Field Engineering. Where specific problems are encountered, our field service engineers are available to help you choose the right cable for the job or to suggest different constructions to obtain better service.



For industrial plants. Armorlokt armored cables eliminate conduit, reduce installation costs.



For highway lighting. Type RR power cable resists soil acids in direct burial.



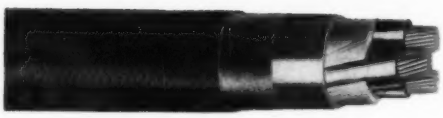
For underwater use. Armored submarine cable supplies dependable power for years.

(more on next page)

Quick facts on USS Tiger Brand Electrical Cables

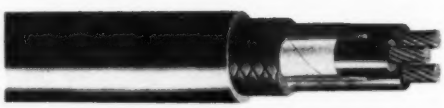
Tiger Brand Paper Cable—Premium quality cable for high voltage use. Regular copper-bearing lead or tellurium lead sheaths available—both protected during manufacture by blanket of inert gas to prevent formation of oxides. All constructions available including neoprene (glass-reinforced) and plastic sheaths.

Tiger Brand Asbestos Cable — Cotton or asbestos braids, lead sheaths or interlocked armor coverings furnished. Available in asbestos or asbestos varnished cambric construction also in the new Type IPE (irradiated polyethylene) construction for extra high resistance to heat and moisture.

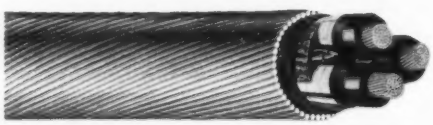


Tiger Brand Varnished Cambric Cable—Furnished in braided coverings (for dry installations), lead sheaths (for underground distribution), or armored coverings (for exposed work). Versatile, dependable, rugged, and economical "work horse" of standard insulations.

Tiger Brand RR Cable—Rubber-insulated neoprene sheath. A versatile cable for control and power applications. Both "conduit and duct" or "direct burial" (heavy jacket) types are available. Many constructions, including self-supporting aerial cable, can be furnished.



Tiger Brand Amerclad—The very highest quality in heavy-duty portable cords and cables. All jackets are vulcanized in a lead sheath, and are permanently marked with molded identifications. Over-all neoprene jackets show phenomenal resistance to abuse, sunlight, grease, oil or acid mine water.



Tiger Brand Submarine Cable—Special marine insulation, used on leadless armored cables, has over 40 years of proven operation in all types of underwater service. American Steel & Wire pioneered the use of aluminum armor for salt water installation.

Tiger Brand Interlocked Armor Cable — Aluminum, bronze, galvanized or stainless steel armor furnished over any type of insulated core. Features higher current carrying capacity (cable in free air), ease of installation and maintenance, and space saving. Rubber or varnished cambric insulations are standard.

Tiger Brand Elevator Cable—Carefully designed to insure the right amount of flexibility for smooth, straight trailing. Annunciator, control, signal, or lighting cables with braid or neoprene covers can be furnished, with steel supporting strand added for high-rise elevators.

For more detailed information, get in touch with American Steel & Wire, 614 Superior Ave., N.W., Cleveland 13, Ohio.

USS, Tiger Brand, Amerclad, and Armorlokt are registered trademarks

American Steel & Wire Division of United States Steel

Columbia-Geneva Steel Division, San Francisco, Pacific Coast Distributors
Tennessee Coal & Iron Division, Fairfield, Ala., Southern Distributors
United States Steel Export Company, Distributors Abroad

Procurement & Products

PRICES ▶ **General Electric Co has announced 5% reduction** of published prices for large power transformers 12,000 kva and higher, and a change in sales terms. To determine published net prices, the discount applying to published list price is increased from 27½ to 41%. For units shipped beyond 12 months from the date of order, prices will be escalated starting from the order date, but such escalation will be limited in any given 12-month period to the increase in excess of 2½%. These changes are to meet competitive market conditions.

OUTLOOK ▶ **Most suppliers are looking optimistically at 1960,** expecting that labor peace will permit them to realize deferred gains in production and sales. Capital spending is on the rise. Price outlook, generally firm to higher. Here are a few industry details:

COAL ▶ **Bituminous coal producers look for a 9% rebound in production** next year, accompanied by strengthening demand. Estimates place 1960 production above 440 million tons, compared with about 405 million tons for 1959. As demand rises, there is the probability of firming of prices and perhaps increases to restore 1959 cuts.

OIL ▶ **Oil demand is expected to rise about 3.5% overall** to a new high of about 10.1 million barrels a day. Consumption rate of heavy fuel oil is expected to rise some 2%. Some firming is evident in residual prices, but outlook depends on import decisions.

ALUMINUM ▶ **Aluminum manufacturers look for 12% gain** in domestic primary production along with a new peak in consumption. Lead and zinc, hurt by the steel strike this year, look for gains in demand of about 10%. The copper industry also looks for a new peak consumption of about 1.5 million tons in 1960, despite the expected decline in housing starts.

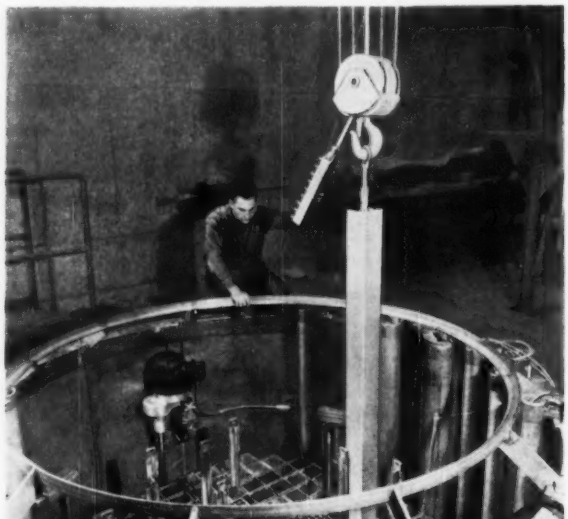
STEEL ▶ **Steelmakers forecast a 40% increase in production** over 1959's strike-riddled output of 91 million tons. This means 128 million tons of ingots and castings—a record by a wide margin. Merely rebuilding steel inventories to normal levels could account for nearly 20 million tons. And the auto and capital goods industries plan to use substantially more steel than in 1959. The price outlook—like the rest of this forecast—depends on the outcome of the steel strike.

STORES ▶ **Among the cost-cutting techniques for the stores** operation at Douglas County (Wash.) Public Utility District are these: Billing machinery is used for stores as well as for general accounting work; Whole dollar accounting is used for stores; An exempt material plan has been adopted.

News of Manufacturers ..... page 80
New Equipment ..... page 85
Readers Service ..... page 90

A-C Energizes Nuclear Test Reactor

Wisconsin's first full-scale critical facility was successfully energized recently at the Allis-Chalmers Mfg Co's Greendale, Wis., laboratory. Following final inspection of the water-moderated, unpressurized, heterogeneous-type reactor, the Atomic Energy Commission issued a license authorizing the operation of this test facility. One of A-C's engineers is lowering nuclear fuel element (left), loaded with uranium dioxide fuel pins, into the reactor core.



This critical facility will be used to obtain physics data essential for the design of a 204-tMw controlled recirculation boiling reactor with nuclear superheater, which will be part of the Pathfinder atomic power plant A-C is building for Northern States Power.

A pit in the floor of a reinforced concrete room in A-C's new laboratory houses the recently energized reactor. The lab is part of the nuclear power department's administrative and physical testing quarters, occupied about a year ago. The reactor has a maximum power rating of 100 watts, thermal, and will normally be operated at essentially zero power output.

The cylindrical core contains two regions. An outer annular region, duplicating the boiling region of a power reactor, contains uranium dioxide fuel pellets in sealed aluminum pins. The inner region is the nuclear superheater which will be fueled by tubular fuel elements.

The experimental program includes determinations of various engineering and nuclear parameters such as total fuel loading, control rod worth, void and temperature coefficients, and neutron flux distributions. Additional foil activation experiments will be made in the critical reactor to evaluate thermal utilization, resonance escape probability, and fast fission factors for various reactor fuel loadings.

Method Detects Incipient Power Transformer Faults

Pennsylvania Transformer Co has developed a method for analyzing the condition of a transformer by gas analysis. The simple but highly-refined means of sampling the nitrogen above the oil can determine if there are conditions within a transformer, which, if allowed to continue, might cause trouble.

Gas samples from more than 100 energized power transformers have been analyzed by this method and in three instances the content of the gas has been found to indicate an incipient fault. The conditions indicated by the sensitive gas analysis have been confirmed on inspection of the transformer, permitting a correction of the difficulty prior to a possible in-service failure, company officials report.

Equipment now available will permit the analysis of a limited number of gas samples, but additional equipment is being made which will make this service more readily available to the utility industry as an accurate maintenance tool for their large power transformers.

At present, gas analysis is being done in the Cannonsburg, Pa., laboratories of the company, using samples supplied from the field by interested utilities.

Pennsylvania transformer plans to make further details on the new detection method available to the industry in the near future.

Work Begins on 350-Mw Single-Shaft Turbines

English Electric has started work on two single-shaft, 350-Mw steam turbine generators, the largest yet to be built anywhere, the company says. The 3000-rpm units will be installed in the Central Electric Generating Board's new Drakelow C power station near Burton-on-Trent, England, under a $14-million contract that includes the feed heating and evaporating plant.

The generator for each of the units will have a water-cooled stator and a 45-psig, hydrogen-cooled rotor.

Steam conditions at the turbine stop valve will be 2300 psig, 1050F,

(*Continued on page* 84)

More than your Dollar's Worth

VICTOR Switch & Bus Insulators

VICTOR No. 730
High Strength Switch & Bus Insulator (EEI-NEMA 58-8)

The No. 730 insulator illustrated above is specially designed for use as stacking units. Because of its great strength characteristics, however, many power men use the No. 730 only as the bottom unit of a stack. It has extra large heavy duty shells (18" diameter), over-size 4-bolt cap and 6¼" bearing surfaces on both cap and pin for extra strong stacking service. Indication of its specialized design and construction is shown by its rated strength characteristics: Tensile strength: 25,000 lbs. Torsional strength: 90,000 lbs. Compression strength: 75,000 lbs.

MARGIN OF SAFETY

VICTOR makes sure that its No. 730 insulators, not only meet but exceed EEI-NEMA specifications. This isn't idle boasting. We give these insulators a real beating in our electrical and mechanical labs. In fact, under electrical load, the No. 730's have withstood mechanical stresses far above their required ratings before destruction. This margin of safety means the difference between performance and failure during an emergency. It is one big reason for choosing VICTOR . . . and why more and more power men are doing just that.

WELL STACKED

As many as seven VICTOR No. 730 insulators may be used in stacking applications. The principal advantage, regardless of the number used in a stack, is strength. Take cantilever strength values as an example. When four No. 730's are stacked, rated cantilever strength is 2000 lbs. When seven are used, the rated value is 1000 lbs. And don't forget—VICTOR No. 730 insulators far exceed their EEI-NEMA ratings in tests in our electrical and mechanical laboratories. This assures any sub-station of a margin of safety that guarantees operational continuity.

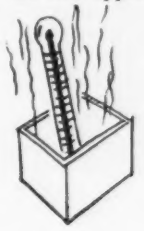
CLAY GIVES US THE SLIP

The raw clays used to make Purified Porcelain are first blended in water to form what is known in the industry as clay slip. Proper preparation of clay slip is a long and costly process but is essential for porcelain of fine texture and top quality and high strength. The ball clays are pre-washed and refined before other ingredients are added. This pre-washing is done in a special agitating machine called a blunger. Here, as in all other mixing operations, specially treated, demineralized water is used.

The ball clay is then pumped into a second blunger where accurately weighed amounts of china clays, flints, and feldspars are added. After further refining, the mix or slip goes into a third agitator, a storage agitator, from which it is pumped into the filter presses where most of the water is extracted.

2300° HOT BOX

After glazing, VICTOR insulators are fired in tunnel kilns. Kiln temperatures are maintained by use of modern automatic control instruments. Kiln cars equipped with silicon carbide refractories are loaded with unfired porcelain and moved continuously through controlled heat areas. The temperature in a kiln increases until it reaches approximately 2300° F. It then gradually becomes lower as the cars approach the exit. For full specifications and details on VICTOR high strength Switch and Bus Insulators, write I-T-E Circuit Breaker Company, Victor Insulators Division, Victor, N. Y.



I-T-E

I-T-E CIRCUIT BREAKER COMPANY
VICTOR INSULATORS DIVISION

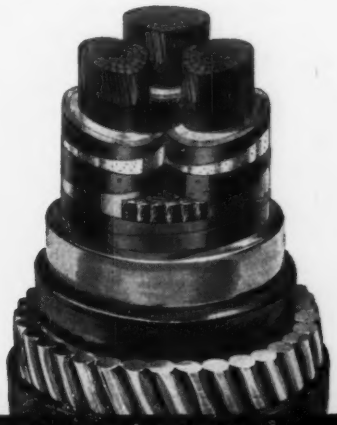
Phelps Dodge

WIDEST RANGE OF HIGH

Consult Phelps Dodge for the correct answer to your requirements, regardless of voltage or type!

offers Industry's VOLTAGE POWER CABLE!

Only Phelps Dodge has manufacturing experience and operational "know how" with the entire range of high voltage cables which includes: oil compression, gas compression, high pressure oil, high pressure gas, pipe type cables; medium pressure gas, low pressure oil-filled, low pressure gas, submarine and solid type cables.



Low Pressure, Gas-Filled Cable, from 15 KV to 44 KV.

Submarine Cable, from 15* KV to 35 KV.

Solid Type Cable, from 15* KV to 69 KV.

*Lower voltage cables in this class also available.

PHELPS DODGE COPPER PRODUCTS CORPORATION

300 PARK AVENUE, NEW YORK 22, N. Y.

with reheat to 1050F. Each turbine will be divided into three cylinders. The high-pressure cylinder will employ a double casing arrangement over the first stages, with the expanded steam returned over the outside of the inner casing to pass through the remaining stages. This enables the pressure differences and operating temperatures in the metal to be reduced.

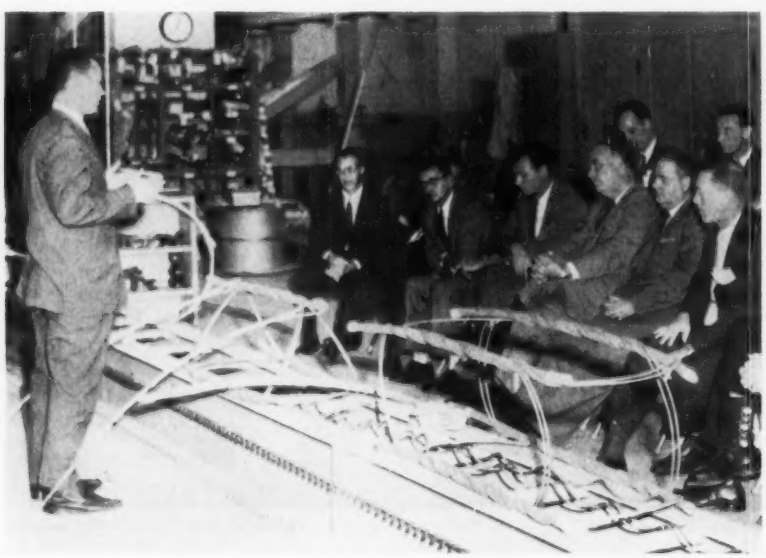
The intermediate-pressure cylinder will have a partial double casing construction similar to that of the high-pressure one. The quadruple-flow low-pressure cylinder will be arranged in two double-flow low-pressure casings, each casing exhausting to one of the two condensers forming the twin condenser unit.

The feed heating system will have seven bled steam stages comprising three surface-type low-pressure heaters, followed by a high level storage deaerator of the direct contact type, and then by three high-pressure heaters of the surface type. The feed system will employ dual pumping, with the three high-pressure heaters interposed between the booster feed pump and the main boiler feed pump.

The water tube boiler will supply 2,200,000 pounds of steam per hour at 2400 psig, 1055F, according to English Electric.

MANUFACTURERS BRIEFS

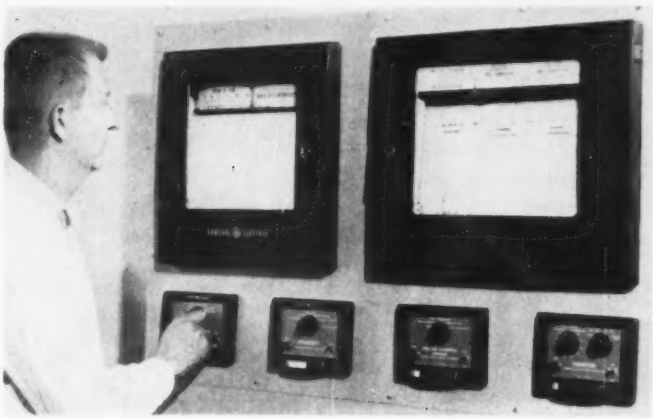
A ground rod made by **Copperweld Steel Co** and installed 24 yrs ago for lightning protection for St. Matthews Church in Surbiton, Eng, near London, recently was removed for inspection and found to be physically perfect and completely free of corrosion. Tests by lightning specialists who drove the ground rod in report a resistance reading of 10 ohms, the same resistance as when installed . . . **Westinghouse** has announced it plans to discontinue operations at its Nutall plant "because declining sales volume can no longer support a separate gearing division." The company will consolidate the division's operation with related product lines at its motor and control division in Buffalo by mid '60 . . . **The Thomas & Betts Co's** net sales for the first nine months of this year reached a new high of $16,144,000, a 29% gain over sales for the same period in '58, and net income was $1,987,600, an increase of 66% over earnings for the first nine months of '58 . . . **General Electric's** medium transformer department completed and shipped a 5,000-kva power transformer within three days to fill an emergency order for Utah Power & Light. It replaced a transformer in a Salt Lake substation which was damaged at the installation site when a hoisting cable, rigged by a local rigging firm, broke and the transformer fell three feet. Although it was later found that the core and windings remained intact, a duplicate unit was ordered because of the extensive examination of the internal structure which was necessary . . . The recommendation of **Westinghouse** directors that stock be split two-for-one will be considered by the company's 143,219 owners of common stock on January 4 . . . **General Electric** is using a new standard packing box for shipping polyphase watthour meters. It accommodates all sizes of S-type meters, protecting calibration. Stronger material is employed and there are only two sections. Structural molding gives consistent cushion values on all surfaces. The standard carton size results in more efficient warehousing . . . **Asplundh Chipper Co,** manufacturing division of Asplundh Tree Expert Co, reports better service is available to utility customers during emergencies through use of a Blu-Ray diazo whiteprinter, which reproduces engineering drawings. It was formerly a critical problem to have copies made hurriedly.



Spacers for 3 and 4 Conductors Shown

Spacers for the bundling of three and four conductors (in foreground above) were exhibited to western sales representatives of Preformed Line Products Co during a recent product indoctrination course. Dual conductor spacers were also shown. Helically-formed rods are common to all.

(For further information refer to Readers Service on page 90)



Instrument Systems . . .

. . . for steam turbine supervisory control have been revised to reduce panel space requirements by 65%. The equipment monitors turbine-generator speed, valve position, shaft eccentricity, expansion and vibration. In addition to supplying the improved TSI systems with all new turbines above 100,000 kw, the company will make them available for all smaller units, and for all steam turbines now in operation.
General Electric Co, Schenectady 5, N. Y.

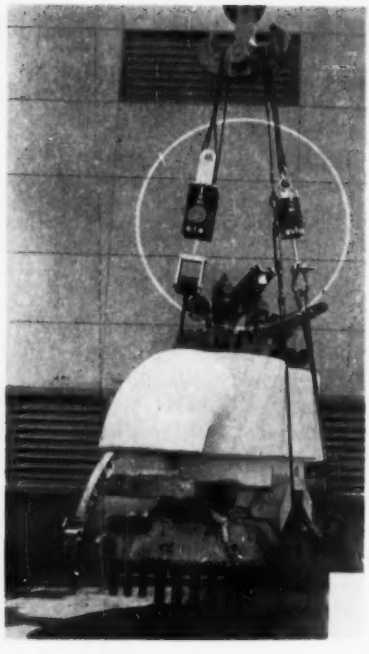
Tilting Insulator Switch . . . ▶

. . . is available in voltage ratings of 7.5 through 23 kv and continuous current ratings of 400 and 600 amp. Switches rated 400 amp have momentary rating of 20,000 amp, while those rated 600 amp have a momentary rating of 40,000 amp. Switches feature reverse loop Amplitact contacts and an extra-large sleet hood which prevents ice collecting on the contact assembly. The TRS is generally applied for line sectionalizing, station disconnecting and line tap disconnecting.
Southern States Equipment Co, Hampton, Ga.

Reverse-Power Relay . . .

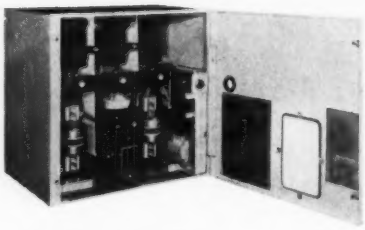
. . . for 3-phase systems is rated 120 v line-to-line, 5 amp. The directionally-controlled timing relay (type CRN-1) has main contacts that can close 30 amp at 250 v dc and carry this current for sufficient time to trip a circuit breaker. Features include high sensitivity of 0.02 amp, 120 v at maximum torque; adjustable timing range from 2.0 to 40 sec; small size case and low burden.
Westinghouse Electric Corp, Box 2099, Pittsburgh 30, Pa.

(More New Equipment on page 86)



Precision Hoist . . .

. . . will raise or lower loads up to 100 tons a distance of 12 in. with accuracy to within 0.001 in. The "HYDRA-SET" is installed as a link between the crane hook and the load. It is self-contained and needs no air or outside hydraulic lines to operate. The unit operates independently of the crane or hoist system and places control in the hands of an operator having personal observation of the parts.
Mefco Sales & Services, Inc, 131 N Fifth Ave, Arcadia, Cal.

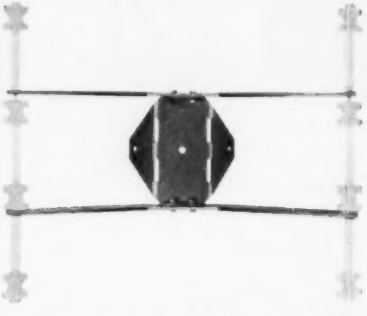


Fuse-Breaker Unit . . .

. . . combines components of conventional low-voltage power circuit breakers and current-limiting fuses. Known as the "Fusematic," the 600-v device is rated up to 1,600 amp continuous and 200,000 amp interrupting capacity. Its primary application is for service entrance and feeder protection where high fault current exists. The low-cost unit uses standard fuses that are commercially available.
Federal Pacific Electric Co, 50 Paris St, Newark 1, N. J.

Secondary Bus . . .

. . . bracket provides efficient, simple and economical means for terminating services and risers of a 3-phase transformer bank. Features include ease of installation, 10-in. conductor



spacing, about a 240-deg climbing space and long bus length. The bracket is hot-dip galvanized and employs standard spool insulators. It can be used as a center support for two spans of secondary.
Line Material Industries, McGraw-Edison Co, Milwaukee 1, Wis.

Vinyl Coating . . .

. . . protects structural steel and other metal fabrications from chemical attack. The coating has exceptional dielectric properties, making it an excellent electrical insulator. Called Quelcor No. 418, the spray coating can also be used for instrument housings, instrument tubing and fittings. It forms a smooth, touch-dry film in as little as one hour.
Union Carbide Plastics Co, 420 Lexington Ave, New York 17, N.Y.

Meter Reading Case . . .

. . . holds 300 or more punched cards for customer billing. They may be arranged in the order the meter reader follows on his route.

He writes the figures on the card with a special sensing pencil, then inserts the card at the bottom of the case.
The Wright Line, Inc, Worcester, Mass.

More New Products

Gear reducers feature universal NEMA motor mounting facility. Both double and triple reduction units are available.—Lima Electric Motor Co, Inc, Dept 75, Lima, Ohio.

Temperature instrument permits full-scale temperature readings over a very small range, selectable anywhere in the region from −50 to +500F.—Royco Instruments, Inc, 365 San Antonio Rd, Mountain View, Cal.

Maintenance and work **platform** can be adjusted to any height from 3 to 7 ft with a 1,000-lb capacity. The unit is mounted on solid tire 8-in. swivel casters.—Aero-Test Equipment Co, Inc, Dallas 7, Tex.

Torquemeter measures torque from several shafts on the same indicator. Up to five torque pickup heads may be used.—Metron Instrument Co, 432 Lincoln St, Denver 3, Colo.

Magnetic **motor starter** is rated through 15 hp, 440-550 v. All components are front removable, and the "trip-free" thermal overload relays have trip indicators.—Furnas Electric Co, 1026 McKee St, Batavia, Ill.

During processing, Anaconda Butyl passes through screens similar to this one—screens fine enough to hold water—fine enough to trap any undispersed particle which might cause future insulation trouble in high-voltage cable.

HOW AN ANACONDA PROCESS HELPS SCREEN OUT SERVICE FAILURE IN HIGH-VOLTAGE CABLE

Even butyl—the most effective rubber insulating material ever developed for high-voltage cable—requires additives to bring out all its superb insulating properties. These additives are usually in the form of finely divided powders which are extremely difficult to disperse uniformly in the raw butyl.

And actual service proves poor dispersion can drastically shorten high-voltage cable life.

That's why Anaconda developed an entirely new mixing process. And why Anaconda built screens (like the one you see above) into the production line to catch every oversized undispersed particle. These screens are so fine, they will actually hold water.

Yet tons of butyl insulating compound are squeezed through before the screens need cleaning—a tribute to the new mixing process. And—to the rigorous quality control which dominates every specialized step in the manufacture of Anaconda Butyl (AB) Cable.

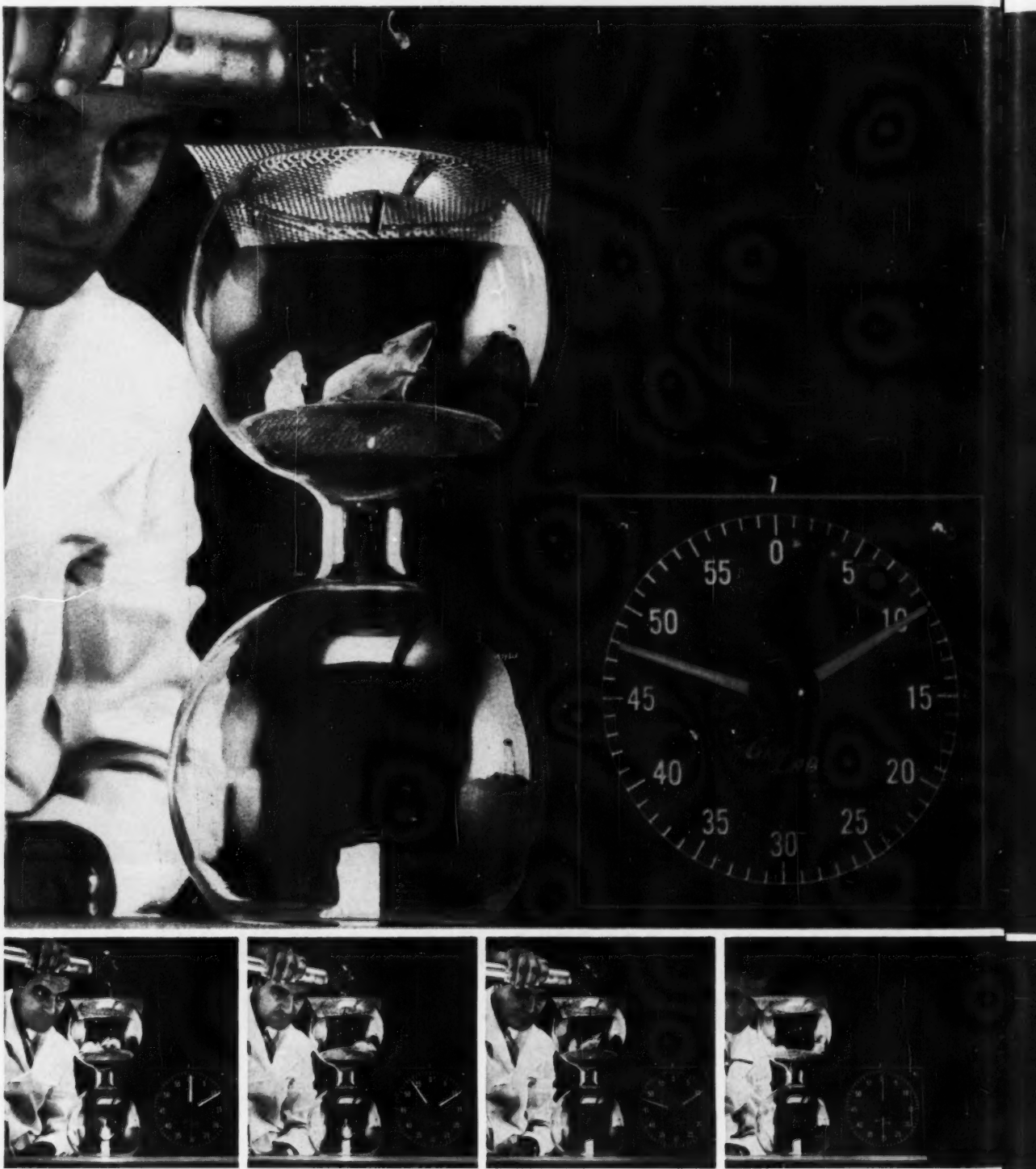
This highly specialized quality control is probably the biggest single reason why Anaconda Butyl (AB) Cable gives such long trouble-free life. Why you should consider it the next time you buy high-voltage cable. Send for Publication DM 5903: High-Voltage Durasheath* Cable to Anaconda Wire & Cable Co., 25 Broadway, New York 4, N. Y.

*Reg. U.S. Pat. Off. 59258

ASK THE MAN FROM

ANACONDA®

ABOUT BUTYL (AB) HIGH-VOLTAGE CABLE



THIS SIMPLE TEST, USING TWO MICE AND A CANDLE, PROVES SF_6 GAS IS COMPLETELY INERT... NONFLAMMABLE, NONTOXIC, SAFE

In this demonstration, time clock is set for 10 minutes, and SF_6 gas is released into top chamber containing mice. Heavier-than-air SF_6 engulfs animals and sinks to bottom chamber, snuffing out candle. Final frame taken 9½ minutes later shows mice in excellent condition. Laboratory tests have shown animals can live in a mixture of 80% SF_6 gas and 20% oxygen for 24 hours without ill effect. Even after repeated arcing in high-power laboratory tests, SF_6 gas is handled without special precautions.

Inert SF_6 gas boosts breaker safety

Makes possible greatly improved performance from 34.5 kv to 460 kv and beyond

A truly unique quality of SF_6 gas as a circuit breaker arc-quenching medium is its inertness. This quality promises safer power breakers . . . as well as breakers that are easier and less expensive to install, to operate and to maintain. The nontoxic, nonflammable properties of SF_6 gas are demonstrated in the photo at the left. In the future, Westinghouse SF_6 circuit breakers, even at extremely high ratings, will be applied in all substations including urban with perfect safety. Quiet operation is assured by the closed gas system.

In addition, SF_6 is highly stable . . . assuring long life of the gas as both an arc-quenching and an insulating medium, even after repeated interruptions. SF_6 (sulfur hexafluoride) has high dielectric strength, recovers full dielectric properties rapidly . . . assures unexcelled arc extinction time after time. Because of the design flexibility offered by this new medium, Westinghouse is now able to bring you equipment that combines the advantages of both oil and air breakers, as well as further advantages offered by neither.

Westinghouse power circuit breakers using SF_6 gas are basically new breakers. But they have proved themselves at several voltages and also promise the most practical design avenue in capacities of 460 kv and beyond.

Westinghouse suggests you buy two of these new breakers in widely separated ratings and apply them in entirely different operating situations. Prove to yourself that they will give you combined performance and economy you cannot get in any other breaker.

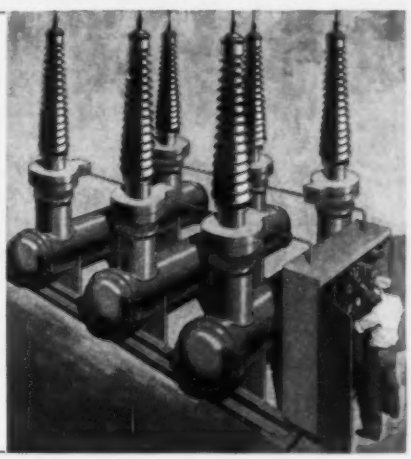
Call your Westinghouse representative today. Or write: Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pa.

J-60982

PROVE THE OUTSTANDING PERFORMANCE OF THIS BREAKER ON YOUR OWN SYSTEM

The principle of circuit breaker design using SF_6 gas has already been proved successful on several operating systems. Breakers from 46 kv to 115 kv have now completed over two years of service.

With SF_6 breakers you get: FAST INTERRUPTION; EASY INSTALLATION; SIMPLE, LIGHT FOUNDATIONS . . . no ground shock during interruption . . . elimination of oil and size reduction cuts weight up to 65% at 230 kv; DRASTICALLY SLASHED MAINTENANCE . . . SF_6 does not decompose . . . interrupter easily removed; COMPLETE SAFETY AT ALL TIMES . . . dead tank construction; QUIET OPERATION . . . no discharge to atmosphere . . . closed system conserves gas.



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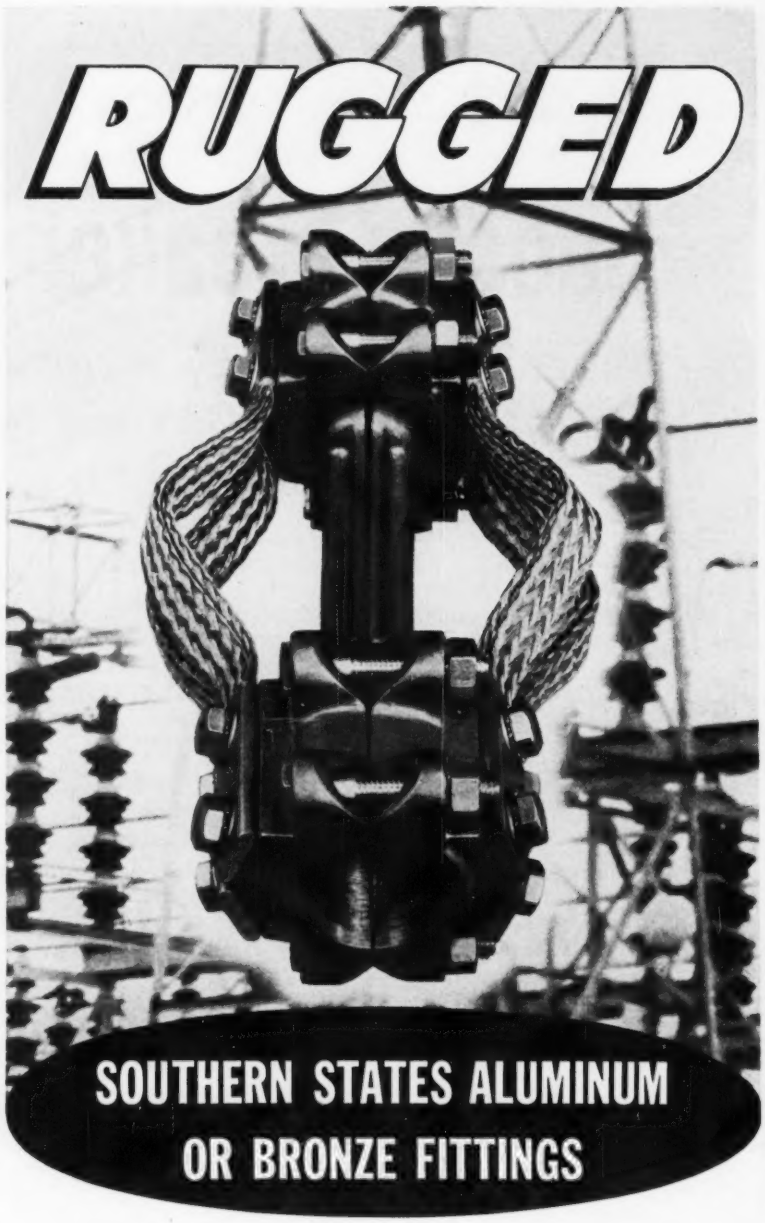

Extra ruggedness at critical stress points receives special attention in the design of Southern States connectors. Ears and walls are husky enough to take the full squeeze of clamping bolts without visible distortion. This extra ruggedness, without excessive bulkiness or weight, is made possible by careful engineering design — backed by more than 25 years experience in producing connectors. *Never underestimate the importance of a good connection!*

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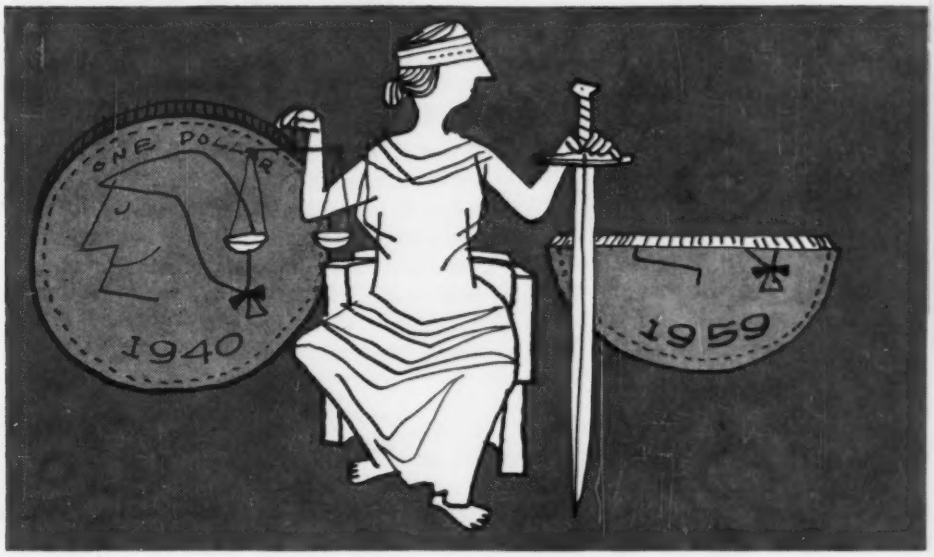


The Case for Fair Value

Inflation must be recognized by the regulatory authorities if utilities are to make adequate earnings. This is one of the basic conclusions of a study by the American Telephone & Telegraph Co showing the importance of profits in the U. S. economy. The past two Management Newsletters have covered those parts of AT&T's study that show the basic role of profits and the need for a concept of earnings that would allow regulated utilities to earn profits more comparable to those of progressive companies in competitive business. This one covers AT&T's recommendations for implementing this earnings concept.

The best route to adequate earnings is the fair value rate base, according to AT&T. Not only is this approach the fair and reasonable one, but also it is the approach offering the best chance of success, the study shows.

The last two decades have seen a steady decline in the value of the dollar. Today's dollar is worth about 48¢ in terms of the dollars of 1940. Inflation on this scale has never before been experienced in this country. While it is true that there has been a long-time trend of inflation throughout our history, the dollar's shrinkage in the past 18 years is greater than the shrinkage that had occurred in the preceding 100 years. The fact of inflation cannot be ignored by utilities any more than it can by other segments of the economy. It must be given proper reflection, and the logical and practical way to accomplish this is by adjusting the rate base.

Fair value gives some consideration to the changed value of the dollar in figuring the rate base. It seldom goes all the way—even the regulatory commissions which accept the fact of inflation have been unwilling generally to give full weight to current cost and have arrived at rate bases somewhere between the current value of the property and its net book cost. This in itself, however, is a long step in the right direction, AT&T feels.

AT&T thinks fair value has the best chance for success in improving earnings **for three reasons.** First, the door is open to value in all except two states (Maine

and North Dakota). These prohibit use of current cost by statute. In all other states, however, the statutes either require a value rate base or else permit its use in finding "just and reasonable" rates. Second, there is much evidence that commissions feel required to stay within the generally accepted level of rate of return —regardless of the rate base. Therefore an improvement in rate base through recognition of value results directly in improved earnings. Third, experience in both the Bell System and the electric utilities has shown that the best earning companies are in fair value states.

In the Bell System, the sixteen highest-earning states over the period 1953 to 1957 included all five of the states where commissions accorded significant recognition of value in finding a fair value rate base. The sixteen lowest earning states were all regulated on net book cost. It is also significant that the eleven book cost states in the high-earners group all presented and urged a value rate base. Among the low earners, only six of the sixteen book cost states claimed a value base. This would seem to show that urging fair value helps rate of return even if it is unsuccessful.

Fair Value Benefits Everybody

Actually, fair value helps the customer as well as the utility. AT&T found that the level of local service rates, the frequency of rate cases, and the percentage increases in rates averaged lowest in the fair value states, and highest in the book cost states where a value base was not claimed. This also seems to hold true for electric utilities with respect to their residential bills. Out of a sample of 103 companies, representing about 85% of the total capitalization of the Class A & B privately-owned electric companies in the U. S., EW reported last year (June 16, 1958, p 71) that the 38 in fair value jurisdictions not only earned a higher rate of return on capital than the 65 in original cost jurisdictions (6.25% on capital vs. 5.43% for companies under original cost), but also were able to charge less for residential service than the companies in original cost states. For a 250-kwhr monthly bill, customers of the 38 companies in fair value jurisdictions paid an average of $7.09 in 1957. Under original cost, the customers of the other 65 companies paid an average of $7.52. About the same relationship held in other bill classifications. In both the telephone and the electric utility industry, the record shows that fair value regulation makes for better earnings, and that better earnings mean better service at lower cost.

The Arguments Against Fair Value

One of the arguments most frequently used against fair value is that fair value may come back and haunt the utilities some day in the future. Some utility managements and regulatory agencies have taken the position that even with inflation the book cost of property is catching up with current cost—so why seek a rate base which will have only temporary benefit and might prove to be a disadvantage if prices should go into a sharp decline?

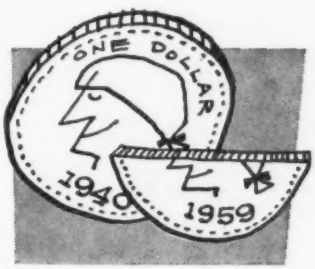
AT&T feels that this argument contains several misconceptions. In the first place, they found, book cost is *not* catching up with current cost. Recent studies in the Bell System show reproduction cost running between 28% and 55% higher than book cost—about the same as in the early 1950's. In the second place, the chances that prices will ever decline to the point where reproduction cost will fall below book cost are slim—in the depths of the Great Depression of the 1930's, current costs for the Bell System stayed about equal to book costs. In the third place, economists expect no let-up in the inflationary spiral, much less a period of declining prices. The Federal debt, the entrenched position of the labor unions, and our system of "built-in stabilizers" such as unemployment

compensation and public works which no longer permits a recession to run its course, all argue that it is idle to expect an end to inflation in the period ahead.

There are other objections to fair value offered by the commissions, of course. AT&T tabulated the criticisms that have been made by commissions and courts of Bell System presentations of current value since World War II. There have been 30 citations to the effect that "Much of the existing plant would not be reproduced because it is obsolete." In 18 cases the argument has run "Most of the plant has been built since the war, so book costs reflect the inflation which has taken place." Three commissions claimed that "Antiquated plant is valued higher than its modern counterpart." Nine said that "Reproduction costs should reflect constructing the plant as one project or contemplate using the latest types of equipment with associated reductions in operating expenses." And in ten cases the use of trending and the use of price indexes as supporting evidence was held to be "questionable." Reproduction cost has also been called absurd, conjectural, controversial, erroneous, fictitious, fluctuating, hypothetical, illusory, inaccurate, indefinite, irreconcilable, nebulous, speculative, theoretical, uncertain, unrealistic, unreliable and unstable.

But AT&T does not feel that these are the real reasons why commissions object to fair value. Says the study: "Some commissions are attracted to original cost as the easy and supposedly less controversial way. Some may suspect a value base to be a device to unwarrantedly benefit the utility investors. Some, who recognize the fairness and necessity of adjusting for inflation, feel that this can be accomplished by some such means as raising the rate of return rather than through the rate base. Finally, there may be some commissions who conceive it their duty to allow only bare minimum rates regardless of equities."

Why Fair Value Is Needed



AT&T feels that it is high time an all-out effort was made to convince the regulatory authorities that fair regulation requires adoption of a value rate base. The case for fair value, though it is sometimes poorly presented, is certainly sound. Essentially, the argument is that fair regulation requires a recognition of the purchasing power of today's dollars.

The established way to fix utility rates is to allow a "fair and reasonable" rate of return on a "fair" rate base. This is absolutely impossible unless inflation is recognized. Book cost regulation simply ignores the fact that today's dollars are of less value than past dollars. The utility investor of 1940 has had half the value of his capital commitment confiscated by book-cost regulation.

For illustration and assuming 7% as the accepted fair rate of return, $1 million invested in plant in 1940 would have earned in 1940 a total of $70,000. These would have been 1940 dollars. In 1958, with the investment still valued in the rate base at $1 million, it still earns $70,000. But these are 1958 dollars, worth only half of the earnings of 1940. Half of the earning power of the investment and, therefore, half of the value has been lost.

This value has not been taken away by inflation. It has been taken away by commission refusal to recognize inflation. Such losses are not sustained as a result of inflation by the owners of non-regulated industries nor by the economy generally. Practically all other activities have been able to adjust to inflation so as not to suffer such a loss. But under book cost regulation utility owners have been singled out and their property confiscated. This is wrong. It is inequitable. It is unfair. And rates which produce this are not "fair" or "reasonable."

For some electric utilities, confiscation has been offset by rapid growth and technological improvements. For others, it has not. Defenders of book cost

regulation avoid the question as to whether they would maintain their principle in the case of "runaway" inflation such as has been experienced in France, Mexico, and elsewhere since World War II, and which would result in the practically complete expropriation of the investors' property for the benefit of the consumers. "It is a fair inquiry of them," the study notes, "as to how far inflation has to run before they are willing to concede that book cost must be abandoned in favor of a realistic rate base reflecting current dollars."

Commissions which insist on a book cost rate base often justify its fairness on the grounds that the allowed rates produce earnings sufficient to attract the new capital needed. The crucial point is that new capital can be attracted despite inadequate earnings if it is obtained without regard for fairness for past investors. The new stockholders merely come in after the market has reflected the loss of past investors. Thus the ability to raise new capital is no indication at all that earnings have been fair.

The Iowa Supreme Court expressed this succinctly in its Fort Dodge decision: ". . . While we do not say that the Constitution of the state of Iowa requires the determination of a fair value rate base, to say that the Constitution in the light of modern judicial pronouncements no longer protects property is to forget that property rights are also human rights. Freedom is invaded when property rights are ignored and this is true when the property confiscated is owned by stockholders through a corporation as well as when it is an individual's home, his livestock, or the tools by which he earns his living."

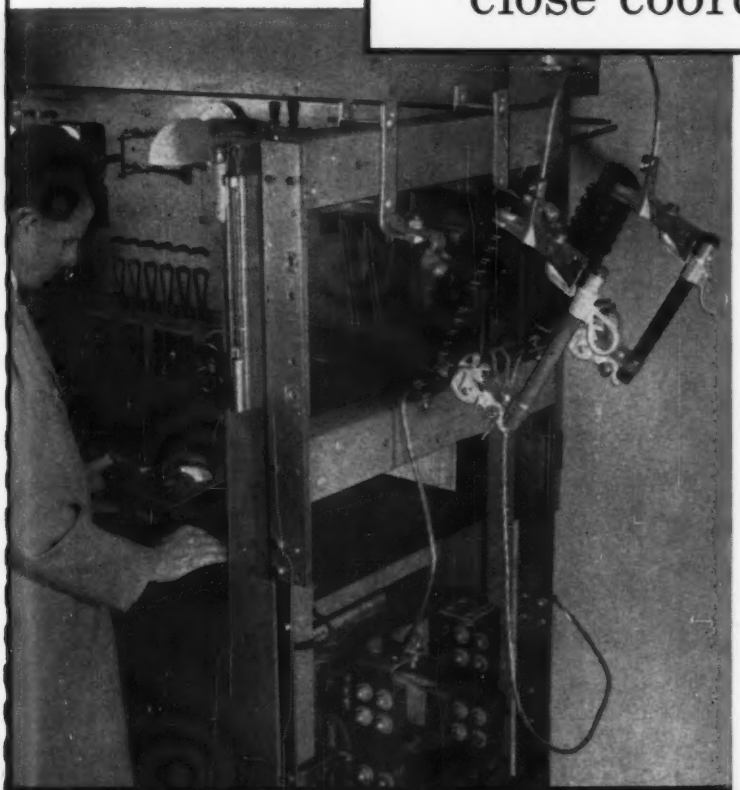
Another argument advanced in support of book cost regulation is that proper reflection of inflation can be provided by adjusting the rate of return. This argument has several flaws. In the first place, the commissions which adopted it generally do not in fact allow rates of return high enough to maintain the integrity of the investment, but apparently base it solely on the "attraction of capital" test. In the second place, providing for inflation through rate of return is misleading: Rates of return are commonly (and properly) compared with ratios such as interest rates, dividend yields, and the like, where the rate is taken against a current value base. For a fair comparison, utility rates of return should also refer to current value. In the third place, it is unnecessarily complicated: Before a commission can reach a judgment as to how much higher the rate of return should be than the rate that would be appropriate without adjusting for inflation, it must determine the relationship between a current value and an orginal cost rate base. Since it has to reach this determination anyway, the simpler and more direct process would be to adopt the value figure as the rate base, and apply the unadjusted rate of return.

AT&T sums it up like this: "There are those who are convinced that the full current reproduction cost new of the property less depreciation should be taken as fair value (although there are differences as to the mechanics and the rationale for determining such evaluation). Others, while agreeing that it is the property that is being valued, would prefer a simple 'repricing' by a broad index or indexes of the changing value of the dollar. Still others consider that it is the capital element, the 'liability side' or investment committed, which should be valued to produce a fair result (here also with alternative formulas and assumptions). Likewise, some maintain that the entire property or the entire invested capital should be priced at today's dollars while others would discount this to the extent of debt capital which is repaid in dollars of the value current when the debt matures. . . .

"The important objectives are that (a) Commissions accept the proposition that in order to apply fair regulation they must recognize that net book cost is obsolete and adopt rate bases materially above book cost and (b) Both commissions and utilities appreciate that value testimony is not final or precise but intended to permit the commission to achieve a fair result."

It takes KEARNEY QUALITY in Fuse Links

to give you positive protection . . . close coordination



Controlled manufacture and rigorous testing provide maximum service continuity

Quality control in KEARNEY Fuse Links starts with design . . . and continues through careful selection of materials, precision parts manufacture, expert assembly and strictest inspection and testing. The end result is dependable protection . . . uniformity that guarantees all Fuse Links of the same rating will perform exactly alike.

ALL KEARNEY Fuse Links feature low temperature operation. Pure tin elements or low melting point solder, selected for proper strength and melting temperature for each current rating, keep temperatures inside the cutout tube well below charring point. This provides accurate, positive arc clearance even after long periods of overload.

Take care of your requirements in Specialized and Standard Fuse Links with KEARNEY. Contact your KEARNEY Representative.

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Plants at: ST. LOUIS • FAYETTEVILLE, ARKANSAS • SHENANDOAH & CLARINDA, IOWA • GUELPH, ONTARIO, CANADA

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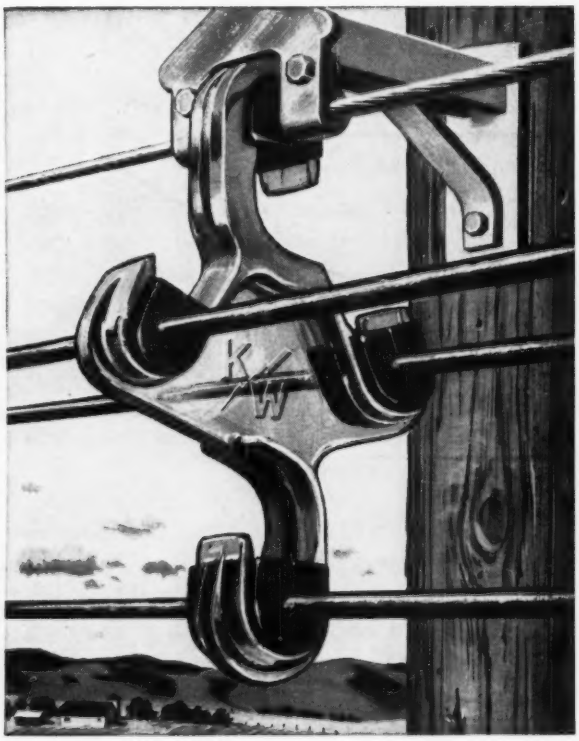
NEW KW SPACER TYPE AERIAL ADDS STRENGTH, CUTS COSTS,



One-Piece Design—Supports 1200 Pounds

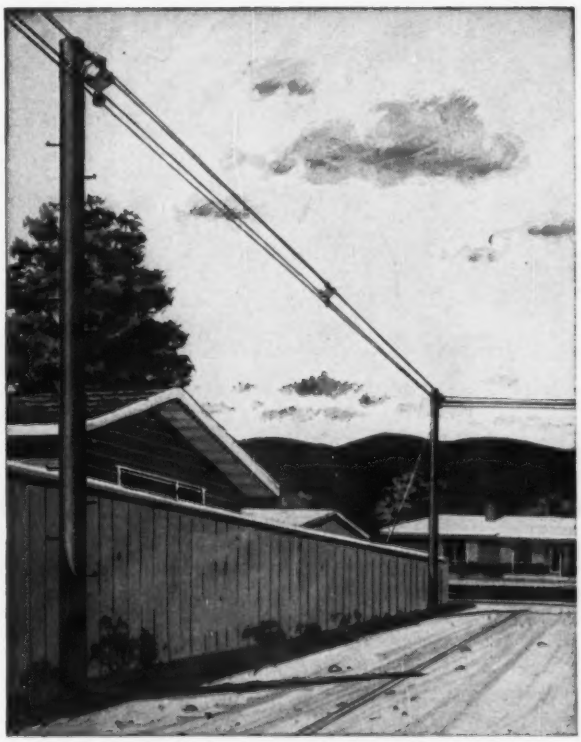
New solid spacer design has no loose parts nor movable pieces . . . it's simple, reliable and strong. Can support a minimum distributed load of 1200 pounds. Easy to install, since only one conductor is handled at a time. Snap-in grommets shaped to ease installation. Can be used with or without crossarms; standard hardware available from many suppliers.

Cuts Material Costs and Tree Trimming

A KW Spacer Cable system can be installed for as little as one half the cost of standard pre-assembled aerial cable!

Compared to open-wire weatherproof, the reduced tree trimming and improved system dependability resulting from messenger supported cables can justify the spacer system's slight additional cost.

CABLE SYSTEM IMPROVES APPEARANCE



Reduced Spacing Improves Appearance

Compared to open wire, closely spaced conductors present a neat, compact arrangement that improves appearance wherever it is installed. Close 6-inch spacing also improves system electrical characteristics . . . permits easy phase identification and proper load balancing. Usual installation practice is approximately 35 spacers per 1000 feet.

WITH its unique new spacer design, KW now offers you unsurpassed dependability and handling ease for cable systems operating at 5 to 15 kv, by using only one spacer for the whole range of voltages.

No tools or tightening necessary: entire spacer system snaps in and locks.

The system consists of four parts: (1) Phase conductors (EC grade aluminum, minimum conductivity 62 per cent, insulated with Polyethylene or Butyl rubber with Neoprene jacket); (2) Special high-strength messenger; (3) Molded one-piece spacers; (4) Molded Neoprene cable-retaining grommets.

Standard hardware is available from leading suppliers. Call your Kaiser Aluminum sales office or KW distributor for immediate service and full information.

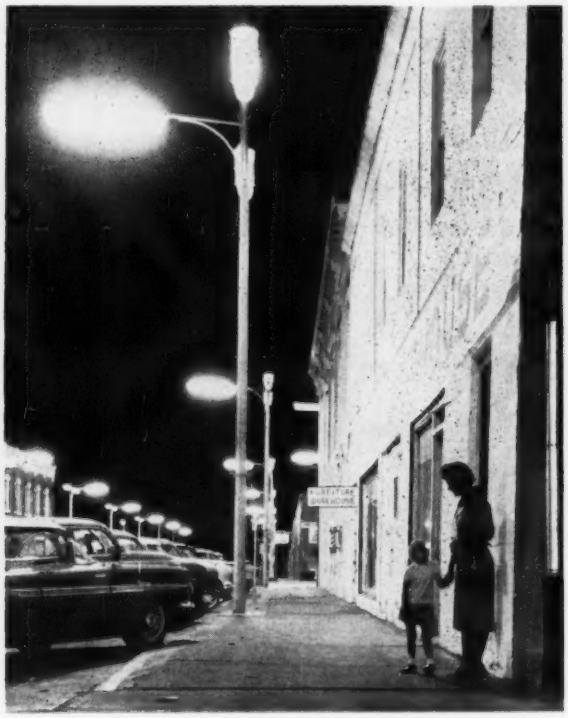
Kaiser Aluminum & Chemical Sales, Inc., 1924 Broadway, Oakland 12, California.

KAISER ALUMINUM

"IF IT CARRIES CURRENT, KW CARRIES IT!"

See "MAVERICK" • Sunday Evenings, ABC-TV Network • Consult your local TV listing.

By replacing old street lights . . .



with fluorescent 'T' standards . . .

Kansas Town Aims to Cut Crime, Accidents

The citizens of McPherson, Kan., are expecting big things from their new street lighting system.

As a result of the new lighting, McPherson city officials predict reduced nighttime crime, fewer traffic accidents, and better business.

"There is strong evidence that good street lighting makes enough difference to be counted as an ally against crime," F. D. Diehl, superintendent of the city's Water & Electric Department, says. "Police reports from all over the country indicate that after streets are properly lighted, crime drops 70 to 90%."

Proof positive of crime reduction has been offered by McPherson Police Chief Paul Smith. "Our street lighting program has just about 'illuminated' crime out of existence in residential areas," he said. In the first year after installation of the residential lighting, there were no window peepings, house burglaries, or prowlers reported in a neighborhood that averaged 30 cases a year during the previous decade, he reported. (EW, Nov 2, 1959, p 53).

Good street lighting as a major factor in drastically reducing nighttime accidents is also well documented, Diehl commented.

It also helps attract desirable new industries. A city, in order to be attractive to industry, must first be attractive in itself, Diehl said industrial development commissions tell him.

A total of 474 luminaires now light the four main thoroughfares leading to the downtown area and four highway intersections on the outskirts of town. They're all part of a $378,000 program started in 1957 with the installation of 1,200 incandescent lights in the residential areas. The three-unit, T-lighting installation downtown provides more than 100,000 lumens each. Single fluorescent fixtures are mounted on each of 56 other poles. Maintained illumination in the business area is 6.5 ft-c, giving McPherson one of the brightest business sections in the nation.

The "T" comes from the way three 6-ft, 40-lamp units on each pole form the letter T.

FHA Approves Built-Ins

Loan insurance for built-in kitchen appliances has been approved under the Federal Housing Authority's property-improvement program. FHA defines a built-in appliance as a gas or electric unit, designed by the manufacturer and installed as a permanently attached, integral part of the kitchen. Free-standing appliances, therefore are not eligible, reports *Living for Young Homemakers* magazine in its newsletter, "Housing Trends."

Stud bushing compartments on G&W load break oil switches permit adding new circuits without interruption to existing loads.

Small city + big plans = TWO-FOLD ECONOMY

for underground distribution system

Sound distribution system planning by engineers of the Modesto Irrigation District in California has paid off handsomely. The system they used was economical to install and economical to expand.

In 1942, when few small cities had 12 kv underground electrical distribution systems, MID engineers began drafting one for Modesto. Work on the new system was started by running feeders from existing 12 kv overhead lines. G&W load break oil switches and oil link boxes simplified installation and provided spare ways for adding new circuits quickly and easily as the city grew. As a result, service interruptions and expense have been kept to a minimum.

Today, after experiencing years of excellent service, MID continues to specify G&W equipment—products backed by long experience, thorough engineering skill and complete manufacturing resources. Consult *your* nearest G&W representative for complete satisfaction on your distribution system problems.

Write for new bulletin giving the full story of the Modesto installation —a down-to-earth job report on how G&W equipment saved time and money.

G&W ELECTRIC SPECIALTY CO.

3500 W. 127th Street • Blue Island • Illinois

Representatives in principal cities • Canadian Mfr. – Powerlite Devices, Ltd., Toronto

Butler Made NEES Sub VP

Theodore H. Butler has been named a vice-president of the Worcester County Electric Co, a subsidiary of the New England Electric System.

He has been executive assistant at Worcester since 1952. Prior to that Butler served with various subsidiaries of the NEES, including the Northampton, Northern and Southern Berkshire utilities, and was vice-president and manager of these companies before coming to Worcester.

Butler, born in Bangor, Me., was graduated from the Massachusetts Institute of Technology in 1925. He joined NEES in 1928 as assistant electrical engineer, later engaging in system engineering work. He served four years with the Navy Civil Engineering Corps during the Second World War.

J. M. Hambley Becomes Ontario Hydro's General Manager

J. M. Hambley has been appointed general manager of the Hydro-Electric Power Commission of Ontario. He succeeds A. W. Manby, effective Jan. 1, 1960.

An electrical engineering graduate of Queen's University, Hambley joined the Commission in 1930 as assistant engineer in the operations department. From 1947 to 1953 he directed operations of the Commission's postwar expansion program.

Hambley later spent four years as assistant general manager of administration, responsible for the Commission's nine regional organizations and for the frequency standardization program. Last June Hambley became deputy general manager.

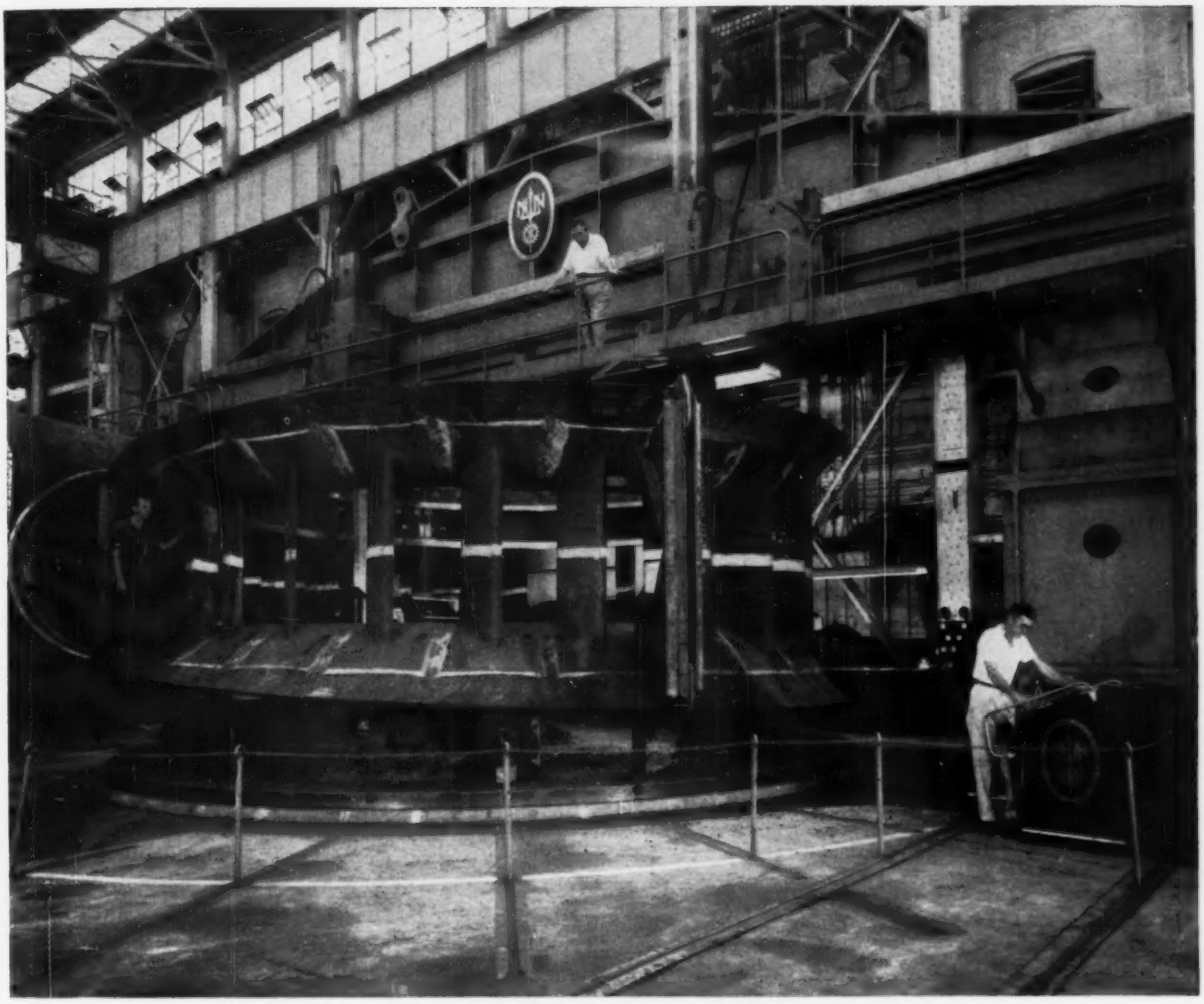
Babcock & Wilcox Names Barr to Head Refractories Unit

Babcock & Wilcox Co has made Robert A. Barr a vice president in charge of the Refractories Division. He succeeds James E. Brinckerhoff, who retires Dec. 31 after 40 years of service.

Barr, who will continue in the company's New York offices, became Refractories Division general manager earlier this year. Formerly assistant general manager of the Carborundum Co's Refractories Division, he has had more than 30 years experience in the refractories field.

A Rutgers University graduate, Barr is a member of the American Rocket Society, the American Ceramic Society and the New Jersey Ceramic Assn.

(*More News About People on page* 103)



42 ft. boring mill-rough cuts a stay ring for one of the world's most powerful hydraulic turbines.

Newport News builds six king-size turbines for Niagara Power Project

These skilled Newport News machinists are milling a stay ring for one of six 200,000 hp. Francis-type hydraulic turbines. Before they're finished, they'll turn out five more turbines—the world's most powerful—for the Lewiston Power Plant of the Niagara Project.

Newport News has not only the men, but the facilities to take a job like this in its stride . . . your job, too. For example, the 42 ft. boring mill pictured above was designed and built at Newport News.

The large engineering and technical staffs, acres of iron, brass and steel foundries, five huge machine shops, and additional specialized equipment make Newport News a leader in the production of hydraulic turbines, valves, gates, penstocks, and other water power equipment you need.

Consult Newport News engineers on preliminary design recommendations at no obligation.

Engineers . . . Desirable positions available at Newport News for Designers and Engineers in many categories. Address inquiries to Employment Manager.

Newport News
Shipbuilding and Dry Dock Company
Newport News, Virginia

POWER-INSTALLED SCREW ANCHORS

average 5 to 8 man-minutes for complete installation

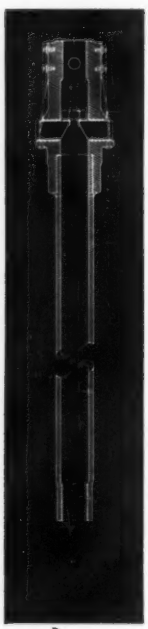
Latest advance in anchoring technique speeds line construction . . . realizes greater value from investment in hole-boring equipment

If your company uses power hole-digging equipment for line construction, you can now use that equipment to install the new line of Chance Screw Anchors.

Chance Power-Installed Screw Anchors, ranging from 78 to 176 square inches in area, can be speedily installed in all types of soil, except extremely rocky soil. Your present power boring equipment, regardless of type, can be easily adapted to power anchor installation. Only one new part is needed—the wrench shown below. This wrench transmits torque from the power equipment directly to the specially designed hub on the anchor helix. Since the anchor rod is not subjected to torque, it only has to be heavy enough to support the guy load—a cost-saving factor.

Installation procedure is extremely simple. *Step one* is to remove the Thimbleye or Twineye nut and slide wrench on the anchor. *Step two* is to fasten the wrench to the "Kelly Bar" of the power-digger, or, to fasten the wrench on the pilot bit of the auger using an adapter. *Step three* is to drive the anchor with the power equipment. *Step four* is to release the wrench from the anchor and retrieve it from the ground. (The spring-loaded "dogs" that lock rod in position are easy to release.) *Step five* is simply replacing the Thimbleye on the end of the rod—your anchor is ready for hooking up the guy wire.

These five steps are accomplished in a matter of minutes. Repeated time tests in various types of soil prove that Power-Installed Screw Anchors averaged only 5 to 8 man-minutes for a complete installation *—from the time the equipment was moved into position until the anchor was ready for the guy!*



THE ONLY PART NEEDED is this special wrench. (Diagram shows how it fits the anchor.) Wrenches are made to fit all popular makes of earth-borers.

THIMBLEYE and TWINEYE guy-wire nuts are available.. They distribute pulling stresses uniformly and keep guy wire from spreading, kinking, or bending.

SHARP CUTTING HELIX of high strength structural steel is tapered to minimize earth disturbance. Special hub fits lower part of wrench.

CA59-23B

PULL TESTS PROVE HOLDING POWER

During the engineering and development stages of these Power-Installed Anchors, several hundred tests were made to check the anchoring dependability of power-installed screw anchors. Each anchor was pulled by a mobile testing unit to determine maximum holding power. Complete test data is given in Bulletin 868. Address your Bulletin requests to...

A. B. CHANCE CO.

CENTRALIA, MISSOURI

A. B. Chance Co. of Canada, Ltd., Toronto

BPA's Kanzler Receives Interior Dept Citation

Walter H. Kanzler, assistant to the chief engineer of the Bonneville Power Administration, has been presented the Distinguished Service Award and Gold Medal, highest award of the Interior Department.

The citation recognizes Kanzler's "more than 19 years of outstanding service demonstrating exceptional engineering and executive ability in the construction of high voltage transmission facilities with BPA."

Kanzler joined BPA as chief of the substation construction section in 1939. From 1951 to 1954 he was assistant chief engineer in charge of all construction activities. For the past five years he has served as the chief engineer's assistant and as construction contracting officer.

McGraw Electrical Award Given to Edwin Herzberg

Edwin H. Herzberg, manager of the Milwaukee Chapter of the National Electrical Contractors Assn, has been presented the Contractors Medal and Purse, given under the James H. McGraw Award for Electrical Men.

The award was given to Herzberg for his initiative and dedicated personal leadership in the development and building of the electrical contracting industry's apprenticeship and training program.

The bronze medal and a purse of $100 were presented to Herzberg at a general meeting Nov. 9 of the National Electrical Contractors Assn in Miami Beach, Fla.

H. S. Freeman and **Earl W. Loveland** have been promoted to new posts at the Connecticut Light & Power Co. Freeman has been named superintendent of the Housatonic Hydroelectric Division, replacing **Albert K. Amazeen** retired. Loveland has become plant foreman at the company's Stevenson Dam on Lake Zoar.

Salt River Project Agricultural Improvement & Power District has named **Walter J. Wall** comptroller, succeeding **Harry S. McCoy** who has retired.

Virginia Electric & Power Co appointed **William S. Sykes, Jr,** supervisor of the internal auditing staff at Richmond.

Central Illinois Public Service Co named **Robert F. Hoffmeister** general storekeeper and **T. P. Carroll** purchasing supervisor of the purchasing and stores department.

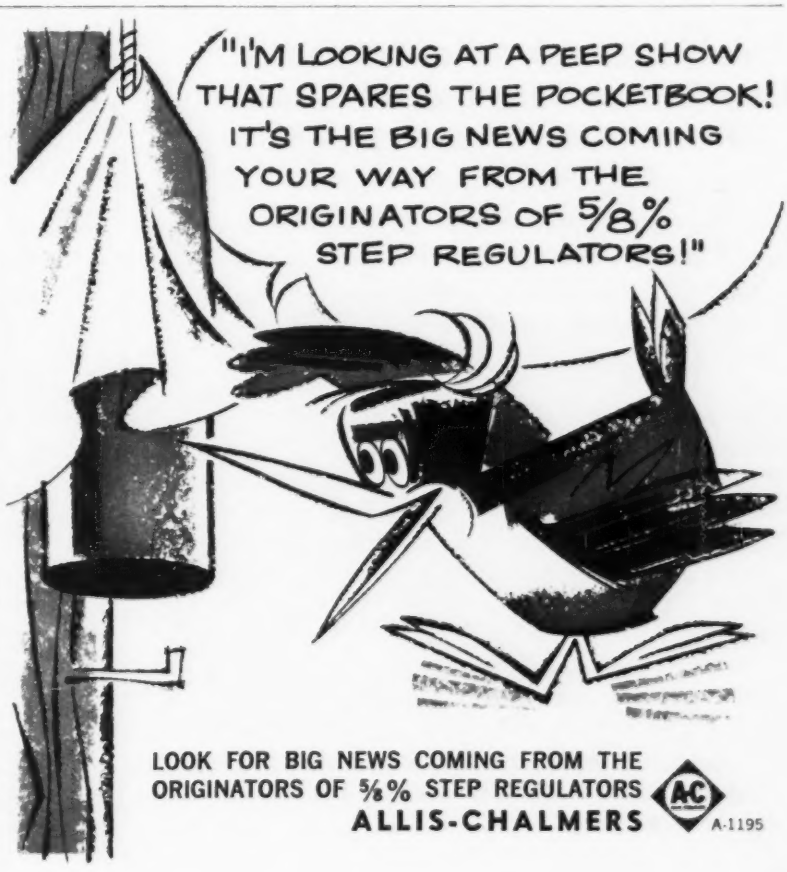
Patti Post, formerly home service advisor for Portland General Electric Co, has been named to head the company's new home economics education section.

Texas Electric Service Co appointed **J. M. Pennebaker** superintendent of the new Graham plant where a 240 Mw unit is now under construction. **Nathan King** will succeed Pennebaker as plant superintendent at Handley.

L. H. Holden became superintendent of Richland's new municipal electric system when the electric distribution facilities were transferred to the city by the Atomic Energy Commission at Richland (Wash.) on Nov. 1.

Pennsylvania's Gov David L. Lawrence appointed Democratic Mayor **Robert W. Anthony** of Altoona, Pa., to the Public Utilities

(*Continued on page* 105)


"I'M LOOKING AT A PEEP SHOW THAT SPARES THE POCKETBOOK! IT'S THE BIG NEWS COMING YOUR WAY FROM THE ORIGINATORS OF 5/8% STEP REGULATORS!"
LOOK FOR BIG NEWS COMING FROM THE ORIGINATORS OF 5/8% STEP REGULATORS
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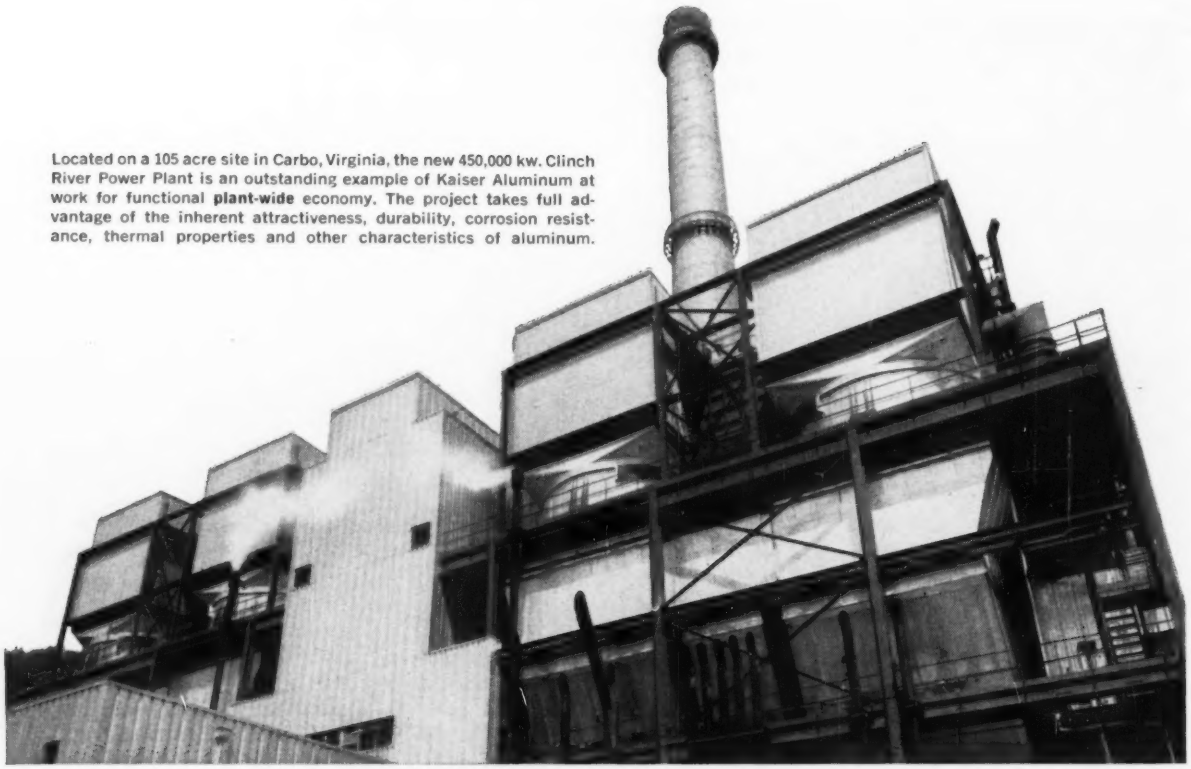

Located on a 105 acre site in Carbo, Virginia, the new 450,000 kw. Clinch River Power Plant is an outstanding example of Kaiser Aluminum at work for functional **plant-wide** economy. The project takes full advantage of the inherent attractiveness, durability, corrosion resistance, thermal properties and other characteristics of aluminum.

NEW CLINCH RIVER POWER PLANT...
PLANNED SAVINGS WITH ALUMINUM

Big savings on upkeep—that's why the Appalachian Power Company chose Kaiser Aluminum ribbed industrial siding to sheath the two giant outdoor boilers at its new Clinch River plant.

Unlike other protective coverings, aluminum will not rust, crack or deteriorate in corrosive atmospheres. Thus substantial long-term savings on maintenance can be expected. In addition, aluminum is non-sparking and highly reflective. And because it is so light in weight and easy to assemble, application is faster and costs less.

All told, 200,000 square feet of aluminum were used to cover Clinch River's two giant boilers.

Other cost-saving applications of Kaiser Aluminum at Clinch River include jacketing on breeching, piping, fly ash collection hoppers—plus siding for buildings, louvers, doors, windows and ornamental trim.

KAISER ALUMINUM *

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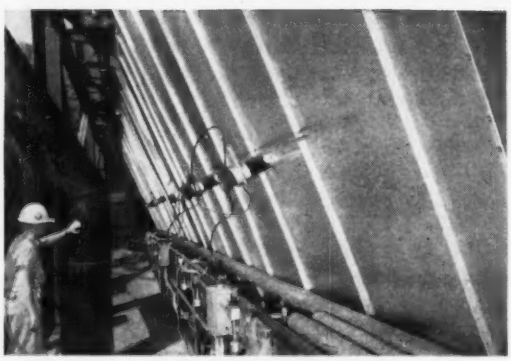

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More Personal Briefs (*Continued from page* 103)

Commission to fill the unexpired term of the late Commissioner Henry Houck which ends on April 1, 1963.

George E. Hill has been named chairman of the Michigan Public Service Commission succeeding **Otis M. Smith,** who was recently appointed Auditor General of the state . . . **Leonard Bessman** took the oath of office as a member of the Wisconsin Public Service Commission, succeeding **George P. Steinmetz** who returned to his former position as chief PSC engineer.

Recent retirements . . . **J. W. Nabors** of Texas Power & Light Co . . . **N. Bruce Cox,** manager of Applachian Power Co's Fieldale district, on Jan. 1 . . . **Arthur Lee Humphrey,** senior engineer, Carolina Power & Light Co.

Electro-Motive Division of General Motors promoted **Mark D. Disoway** from senior engineer to assistant export sales manager.

General Electric Co has made these appointments recently: **James L. Richardson** to advertising and sales promotion manager of the distribution transformer department, and **J. G. Henderson** to manager of industrial sales for the Atlantic district of the Apparatus Sales Division.

Utility Division of the Highway Trailer Co has named **D. V. Wedeman** general sales manager.

Hubbard & Co appointed **George Pope** manager of manufacturing at the Cicero, Ill., plant.

C. P. Pesek, Minnesota Mining & Manufacturing Co vice president for engineering and staff manufacturing, has been elected to the 3M board of directors.

A. A. Snowball, vice president in charge of sales of Pittsburgh Standard Conduit Co, has been made chairman of the Rigid Steel conduit section of the National Electrical Manufacturers Assn.

Howard D. Tindall joined Delta-Star Electric Division, H. K. Porter Co, Inc, as manager of transformer sales and engineering.

Kenneth D. Cummings appointed assistant sales manager for the Moe Light Division of the Thomas Industries Inc.

Triangle Conduit & Cable Co named **Glenn J. McMahon** to plant manager of the Conduit & Armored Cable Division.

Westinghouse Electric Corp has made these recent appointments: **Lauris L. Grant** to marketing manager of the semiconductor department; and **George E. Richardson** to manager of the power transformer plant now under construction in Muncie, Ind.

Rome Cable Division of the Aluminum Co of America has made these recent appointments: **F. R. Dallye,** product manager for electrical conductor accessories; **W. W. Knapp,** product manager for overhead transmission and distribution conductors; **D. H. Thayer,** product manager for building construction conductors, and **J. R. Woods,** product manager for power conductors. Dallye will be located in the Pittsburgh office while the other three will be stationed in Rome, N. Y.

Allis-Chalmers Manufacturing Co appointed **Derio Dalasta** head of the switchgear department's new static relay section.

Atomic Industrial Forum elected the following members of the board: **Roy M. Casper,** vice president, Allis-Chalmers Mfg Co; **Lee J. Davenport,** president, Sylvania-Corning Nuclear Corp; and **Ernest H. Wakefield,** president Radiation Counter Laboratories, Inc.

William Brand, founder of William Brand & Co, Inc, has resigned.
(*More News About People, p* 106)

"HE'S IN FOR A MIGHTY BIG SURPRISE WHEN HE FINDS OUT HOW MUCH EASIER INSTALLATION CAN BE... AFTER THEY UNLOAD A TRUCKFUL OF GOOD NEWS FROM THE ORIGINATORS OF 5/8% STEP REGULATORS!"
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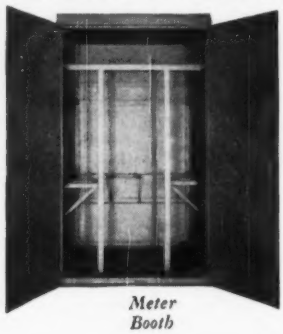
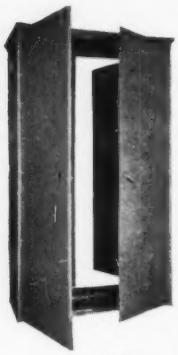


Meter Booth

Current Transformer Enclosure



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The Swedish Increment Borer is by far the best instrument yet devised to determine the characteristics of standing timber. It is extremely light, small in bulk, handy and portable. It makes the smallest possible hole consistent with the purpose of boring; and materially reduces the expense of boring. It makes for accuracy in observation, since the cores obtained with it are exact and permanent records which may be examined at leisure under the best conditions. No skill is required to operate it.

These increment borers are being used by the Federal and State Forest Services, lumber companies, telegraph and telephone companies, creosoting companies, etc.

SWEDISH INCREMENT BORERS

Length of Bore	Instrument Complete	Bit only	Extractor only
2¼ in.	4330½	4330½ B	4330½ E
4 in.	4331½	4331½ B	4331½ E
6 in.	4332½	4332½ B	4332½ E
8 in.	4333½	4333½ B	4333½ E
10 in.	4334½	4334½ B	4334½ E
11¾ in.	4335½	4335½ B	4335½ E
13¾ in.	4336½	4336½ B	4336½ E
15¾ in.	4337½	4337½ B	4337½ E

More Personal Briefs

(*Continued from page* 105)

Frank T. House has been appointed sales promotion manager and **Hermann A. Burkhardt,** publicity manager, for Bucyrus-Erie Co.

Buffalo Forge Co elected **George P. Schivley** (director of manufacturing) a director. **Milford E. Reiner** was appointed treasurer of the firm.

Clinton V. Newman has been promoted to product manager for rod and wire by Chase Brass & Copper Co, a subsidiary of Kennecott Copper Corp.

Herbert C. Craig appointed to the new position of marketing manager of oil-paper capacitors of the Cornell-Dubilier Electric Corp.

Triangle Conduit & Cable Co has made the following personnel appointments: **Stephen Belansky** to director of industrial relations and **Peter E. Johnson** to assistant director of industrial relations and **John F. Bahr** to general traffic manager, succeeding the late Henry Hahn.

Wayne Steinbarge promoted to the newly-created position of power factor capacitor marketing manager of the Cornell-Dubilier Electric Corp's Power-Factor Division.

General Electric Co has made these following appointments: **Peter Gianaris** to manager-materials for the Everett Founderies of GE's foundry department; and **Richard W. Kinnard** to manager-finance of the company's metallurgical products department.

George P. Epstein appointed marketing manager, home laundry department, Hotpoint Division of General Electric Co, succeeding **John C. Maynard** who resigned recently.

Standard Wire & Cable Co has made **Barney L. Sutton** divisional manager of the sales and marketing operations in the San Francisco Bay area.

Promotion of **Dr R. W. Fritts** to manager, thermoelectric project, has been announced recently by

Minnesota Mining & Manufacturing Co.

Allis-Chalmers Manufacturing Co has made these appointments: **John M. Bandarra, Jr, Karl G. Grothues,** and **Donald W. Koppelman** to the Power Equipment Division; **Thomas V. Wambach** to the nuclear power department; **John Lewis Chisum, Jr,** and **Walker L. Hopkins** to the General Products Division; and **H. M. Raber** to works manager of turbines at the York Works.

American Institute of Electrical Engineers has elevated the following members to the grade of Fellow: **Willard R. McCarty,** supervisor of electrical engineering, department of research and development, Wagner Electric Corp, "for contributions to techniques of high voltage and transformer testing"; **Randolph W. Burrell,** senior engineer, outside plant bureau, Consolidated Edison Co of New York, "for his contributions in the field of power cable engineering and soil thermal restivity research"; **Alfred L. Pollard,** operating manager, Puget Sound Power & Light Co, "for contributions to development and operating management of a large electric utility"; **Ralph E. Thornton,** superintendent of engineering, Oklahoma Gas & Electric Co, "for contributions to planned expansion of a utility power system"; **Asa H. Myles,** chief engineer, Electric Controller & Manufacturing Division, Square D Co, "for contributions by invention and development to electric controls for heavy industry"; **Walter R. Wilson,** manager of engineering, high-voltage switchgear department, General Electric Co, "for contributions to development of high-voltage switchgear."

Central Maine Power Co named **L. Earle Hutchinson** as contractor, plumber, architect, and builder representative, succeeding **Lloyd N. Benner** resigned.

Jack Cottingham, Portland General Electric Co lighting sales specialist, appointed regional vice president of the Pacific Northwest region of the Illuminating Engineering Society.

James B. Berg was elected an assistant treasurer of the American Electric Power Co, New York, and of all its subsidiary companies.

Bertice M. Haskin has been named area personnel representative, Chattanooga employment office of the Tennessee Valley Authority.

General Manager A. R. Luedecke of the Atomic Energy Commission has established the office of assistant general manager with responsibility for commission activity in the fields of licensing and regulation, license compliance, health and safety and relations with state governments. Appointed to the post of assistant general manager for regulation and safety is **William F. Finan.**

Louis E. Rydell, chief of the planning branch of the Walla Walla district of the Corp Engineers, will join the staff of Harza Engineering Co, Chicago, on an assignment in Pakistan on development of the Indus River.

Thurman L. Rundlett, formerly with Westinghouse, joins Anderson Electric Corp as chief engineer.

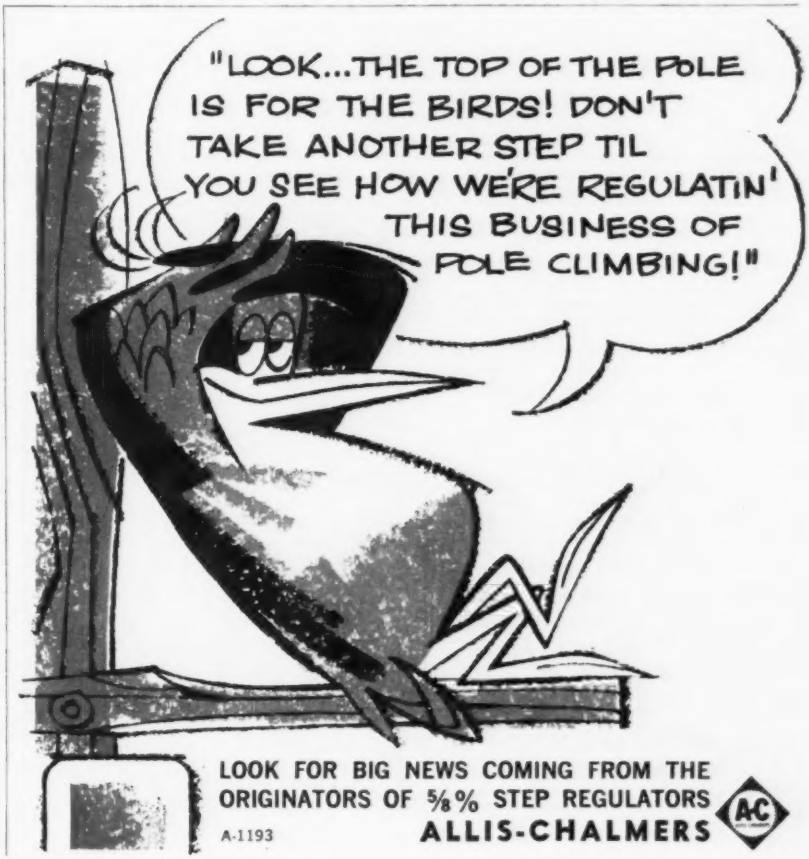
OBITUARY

H. G. Carlin, 61, auditor for the Alabama Power Co . . . **William Nelson Beatty,** 77, former tax and land agent for Utah Power & Light Co.

Henry D. Fitch, 86, retired president of the Kentucky-Tennessee Light & Power Co . . . **Ivan A. Patten,** former general superintendent of the Lynn Gas Electric Co . . . **Robert W. Bloom,** 59, Central Illinois Light Co . . . **J. Frank Dreher,** 76, retired member of the public relations department of the Philadelphia Electric Co . . . **Paul V. Galvin,** 64, chairman of the board and founder of Motorola Inc . . . **Alfred P. S. Bellis,** 78, retired chief electrical engineer, John A. Roebling Sons Co.

Myron D. Miller, 36, executive secretary of the National Mineral Wool Assn and formerly with the National Electrical Manufacturers Assn.

Floyd M. Roush, 63, regional supervisor for the Reclamation Bureau.


"LOOK...THE TOP OF THE POLE IS FOR THE BIRDS! DON'T TAKE ANOTHER STEP TIL YOU SEE HOW WE'RE REGULATIN' THIS BUSINESS OF POLE CLIMBING!"
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3—1000 kva Westinghouse, 1/22900/480
3—1000 kva Westinghouse, 1/13800/480
3—1000 kva Westinghouse, 1/13800/2400/4160Y
3—1000 kva Standard, 1/44000/6900
3—1000 kva Standard, 1/69000/4160Y/2400
3—1000 kva Standard, 1/34400/480
3— 833 kva Allis Chalmers 1/60/12,000—480
3— 200 kva Westinghouse, 4800—240x480
3— 100 kva G.E., 2400/4160Y—120x240
3— 75 kva G.E., 2400/4160Y—120x240

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Representative wanted for manufacturer of street lighting equipment pole line specialties. Full particulars. RW-9821, Electrical World.

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Graduate Electrical Engineer, ten years' commercial, residential power promotional experience. PW-3226, Electrical World.

Distribution Engineer, 15 years experience in transmission and distribution design and construction, presently working on a modernization program in Asia, desires another foreign assignment of short duration. PW-3246, Electrical World.

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Electrical Engineer. Permanent position as Distribution Engineer for mid-week municipal electric utility. Experience in design, planning and operation of 2400/4160 volt distribution lines. Excellent opportunity for advancement. Age 35-45. Salary open. P-3149, Electrical World.

Teaching position in E.E. Teach machinery courses, some graduate classes at night. Must have M.S. or PhD degree. Appointment in February. Contact head Electrical Eng. Dept. University of Akron, Akron 4, Ohio.

POSITIONS VACANT

BSEE with 5 or more years experience in transformer design and test. Excellent opportunity in fast growing transformer manufacturing company in Southwest. Salary commensurate with experience. Send personal biography and resume of experience to: P-3177, Electrical World.

Electrical Engineer. Board layout workpower, lighting, and control systems; calculations; and occasional field contacts. Extremely wide variety of work with opportunity to enter consulting field and grow with progressive midwestern concern. All replies will be answered. P-3222, Electrical World.

Electrical Engineers. Foreign Assignment. Utility experience required. Design and construction supervision of transmission and distribution lines, substations and equipment and rural electrification project. Mail experience record to: Miner and Miner, Consulting Engineers, Inc., 5598 South Broadway, Littleton, Colorado.

T & D Engineer—Young graduate electrical engineer with experience in transmission and distribution design and construction; supervisory ability; northern Maine utility; send complete resume and photograph. P-3255, Electrical World.

Excellent opportunity with rapidly expanding Southwestern utility for an Electrical Engineer (BS in EE) under age 35 with three to five years of power system experience. Consideration would be given for experience in one or more of the following fields, substation design; relay and communication; distribution planning and design; short circuit calculations and A. C. board study experience. Address complete resume of experience and education to: Public Service Company of New Mexico, P.O. Box 1360, Albuquerque, New Mexico, Attention: Mr. W. L. Hunt.

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the box number when answering advertisements. It is the only way we can identify the advertiser to whom you are writing.

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Ellis Reviews Tour of U.S.S.R. (*Continued from page* 42)

because of their tremendous size.

If you are speaking of techniques, then I would list the Russian practices of developing a river's energy potential completely, the preformed concrete construction, the larger and allegedly more efficient generators and transmission lines.

Most significant of all, at least to me, is the realization that here, for the first time in our history, is a nation determined to take from us the industrial leadership of the world. Russia has the natural resource potential and the human resource potential to do just that. Her people are fanatically dedicated to that end.

Those of us who take lightly the Russian effort would do well to review the history of the U. S., and to contemplate the nations which paid little regard to us 150 years ago.

Russians are increasing the voltage level of the 400-*kv ac transmission system to* 500 *kv nominal. Did you see any of this work in progress?*

We saw the 400-kv line from Kuibyshev Dam on the Volga to Moscow in operation and were told that within a matter of weeks it would be stepped up to 500 kv. We saw and got pictures of both it and the 400-kv meter. The line has already been tested at 500 kv and the insulation found adequate. The step-up to 500-kv will require only some transformer changes, we were told. We also saw the 500-kv line from Stalingrad Dam to Moscow under construction and were told it would be put into operation before the end of this year.

Have you any comments on the relative transmission distances and load concentrations on U.S. and U.S.S.R. transmission systems?

In terms of geographical area, the Soviet Union is the largest nation in the world. Much of its area is still virgin land. Major load centers are in some cases widely separated, from each other, and from major hydroelectric sites. High-voltage transmission is being used to bridge these gaps.

The Russians are, however, also locating major industrial loads at the big hydroelectric damsites. And the high-voltage lines being constructed to interconnect these generating-load complexes will assure system reliability and maximum utilization of time and stream (low diversity).

How does the rural and domestic kwhr use in Russia compare with the U.S.?

In 1950 state and collective farms used 1-billion kwhr, according to official Soviet reports. By the end of 1958, power use had increased to 4.3-billion kwhr.

Even if this figure is accepted, it is far short of the 24.7 billion kwhr FPC estimates were used in the U. S. rural areas during 1958.

Industry will continue to be the major beneficiary of rapidly-growing electric power production, but as rural lines are built agriculture will also benefit. Likewise, as farms and homes buy more electrical consumer goods, per predictions, power use will rise. Russia's rural power use tripled in the six-year period 1953-1958.

How much do the Russians use electrical appliances in their homes and electric power on their farms? Is there a program to expand such use?

Our actual observations were limited to a few homes and, therefore, are inconclusive. But from Russian officials, from Russian reports and from other sources, we gained other information: Lighting with low-wattage bulbs is the rule in homes and farm buildings. Many homes have radios, some have television sets and a few have electric irons and hot plates. Some Russian homes have electric washing machines. Few have other electric appliances.

Most state farms, but only about 4% of the collective farms, use electric milking machines. Electric motors have limited use with feed grinders, grain cleaners and for pumping water. Soviet plans call for increasing the production of electric motors and equipment for their use. Production of appliances also is to increase.

"I'M BUSHED! THIS NEW ROOST IS TOO SLICK TO LAND ON. USED TO BE THESE THINGS WERE FULL OF BUTTONS AND BOLTS--- NOW THEY'RE SMOOTH AS AN ICE-COATED INSULATOR!"
LOOK FOR BIG NEWS COMING FROM THE ORIGINATORS OF 5/8% STEP REGULATORS
ALLIS-CHALMERS
AC
A-1194

Iowa Electric L&P's DO'S and . . .

- Get to know your news contacts well. In that way they'll not hestitate to consult you on articles . . .
- Assume, until you learn differently, that every press representative is a gentleman who can be entrusted with advance information and will observe release dates . . .
- Be candid in your dealings with the press.
- Be available and willing to help when you receive press inquiries.
- Try to anticipate reportorial needs so that you may have background, biographical and photographic material available at the time of need.
- Arrange to provide the reporter with a typewriter, paper, a telephone and any other facilities he may require if he must write his story on the spot.
- Buy space and run an ad if you want something in the paper as you have prepared it. News releases are invariably rewritten and edited to fit into other editorial considerations of the moment.

DON'TS for divisions, districts

- Assume that good public and press relations are controlled by a faucet to be turned on or off at will.
- Assume that you are entitled to special consideration because you are an advertiser.
- Assume that you know more about public or reader interests than the editor. Such an assumption will antagonize him and do you no good.
- Always be on the asking end in your relations with the press. Think of the reporter when you encounter a potential news story which is not part of your own promotion and which he might otherwise miss.
- Have the reporter cool his heels in your lobby. Remember his deadlines. If it is impossible to see him at once, get word to him so that he won't have to dangle.
- Ever say "no comment." That's asking for the worst. Explain "why" if you can't provide information. Reporters respect valid reasons.

Managers Get a Guide on Good Press Relations

Harold Rowe is a man who prefers not to leave things to chance, particularly when it comes to maintaining good relations with newspapers and radio-TV stations. This explains his attention to fundamentals and sound advice on press dealings in a booklet recently distributed to Iowa Electric Light & Power Co's division commercial managers and district operating managers.

The booklet urges an "open-door press policy" calling for honesty, intelligence, consistency and common sense. Rowe, who is the company's public information director, underscores the booklet's purpose by urging managers to "establish a reputation for full cooperation with news media."

Managers are provided with down-to-earth counsel on copy preparation, phraseology ("we may have 'emergencies,' but never 'disasters'"), what makes news, and planning ahead. The booklet points out that help is always available from the information department.

Sample news releases are included on interruptions—both planned and unexpected—and employee recognition for service anniversaries, promotions and retirements. A system map is provided and Rowe suggests that the managers keep on hand detailed information on the local distribution system and layout of the local powerhouse.

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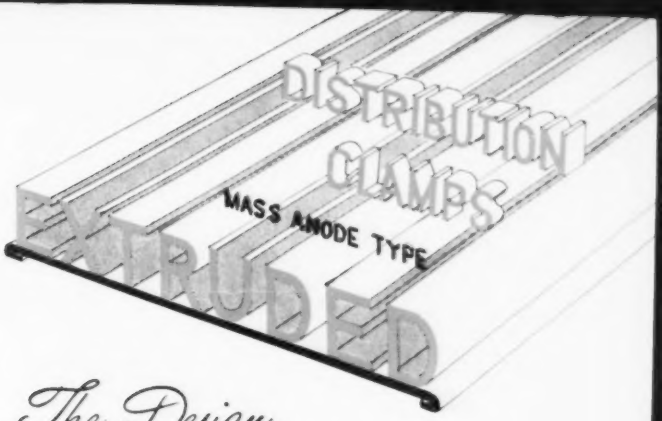


The Design

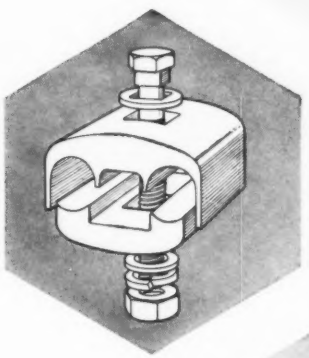
Body and bridge align themselves to contain and contact all strands. All conductor combinations, even one max. and one min., are contacted with pressures exerted in *exact* opposite directions (always toward the core). Conductors are never distorted.

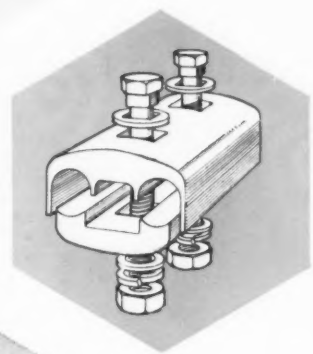
The Material

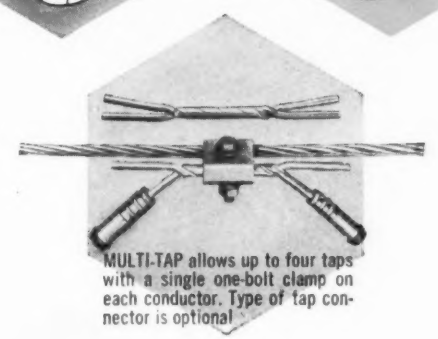
1. EXTRUDED ALUMINUM because conductivities are as tabled:

ALLOY	SUITABLE FOR	VOLUME CONDUCTIVITY (% International Annealed Copper Standard)
No. 6063 — Aluminum	Extrusions	55
No. 220 — Aluminum	Sand Casting	21
No. 356 — Aluminum	Die Casting	41
Alum Brz. (90 Cu., 8.9 Al., 1.0 Fe)	Casting	12.6
Copper Conductor	Draw	97
Aluminum Conductor	Draw	61-62

2. EXTRUDED ALUMINUM because shapes as designed are always true and the quality consistent.







MULTI-TAP allows up to four taps with a single one-bolt clamp on each conductor. Type of tap connector is optional.

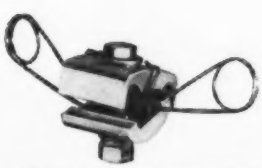
The Bolt

Galvanized Steel — Lubricated.
Square shank for 1 wrench,
Hex head for 2 wrenches

Types

One and Two Bolt — Four Sizes

LINE	TAP
1/0-8	1/0-8
4/0-2	4/0-2
336.4-1/0	336.4-1/0
336.4-1/0	1/0-8



HOT CLIPS, a reusable accessory, hold the line and tap sides ready for installation hot, using standard hot line tools.

The coefficient of linear expansion closely matches that of aluminum conductor, minimizing any ratcheting effect when brought through cycles of heating and cooling. The design of the clamp, based on the mass anode principle, reduces galvanic corrosion to insignificant proportions. This eliminates the need for copper liners for copper to aluminum connections.

Reliable

ELECTRIC COMPANY
Franklin Park, Illinois

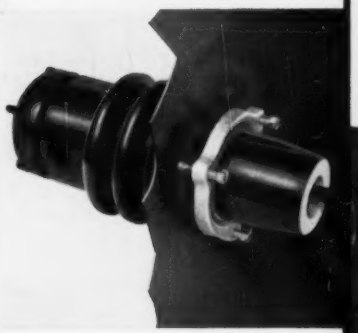
A Symbol of Integrity Since 1933

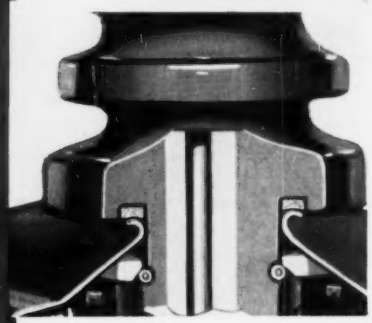
THESE SUPERIOR MOLONEY FEATURES ASSURE DEPENDABLE SERVICE

Moloney Distribution Transformers are available in both conventional and CSP types featuring the Moloney Core and a low impedance coil.

All bushings are made of high strength, wet-process, porcelain and are internally clamped using one piece Almag clamps. The high voltage bushings have a configuration design to obtain liberal creepage without excessive height and to assure high impact strength. Each gasket is made of reusable cork-neoprene and is retained.

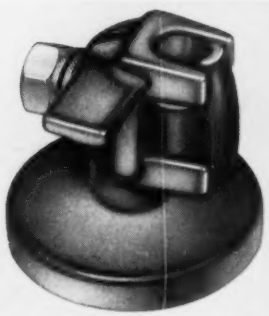
Sidewall bushings have the hardware keyed to the porcelain and the porcelain keyed to the tankwall, thereby preventing rotation of the bushing or any of its parts. Sidewall mounted high voltage bushings are equipped with a special cap for clamping the conductor in place quickly and safely without the use of tools.

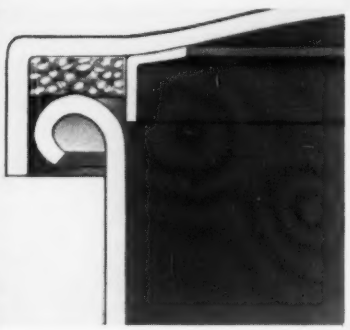




Cover mounted bushings are mounted on a smooth flange raised above the cover. This smooth rounded flange and the shape of the porcelain positively prevents the entrance of moisture. The contour of the flange eliminates corona at this point. Protective caps are provided for all cover mounted high voltage bushings.

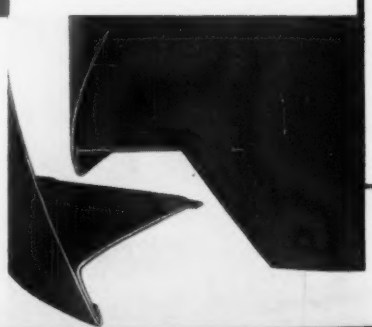
Connectors are electro-tin coated and large enough to accommodate either the copper conductors specified by EEI-NEMA Standards or the ACSR equivalent. The large contact surface and a double-coil spring-type washer reduces conductor cold flow.





The tank and cover are die-formed assuring consistently accurate fit. The cover overhangs the tankwall and is dome shaped to shed moisture. The combination of a rolled top rim, cover overhang, cork-neoprene gasket and the gasket retainer positively seals the tank from moisture.

The base is welded to the tank wall. Then a sealing mastic is applied and the tank wall is rolled under the base flange to provide a triple thickness of metal. The tank and cover are painted by a hot-spray process and each coat is baked to form an extremely durable finish.



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